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SOCIETY OF
MOTION PICTURE
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ENGINEERS

Society Engineering Activities

Explosive Argon Flashlamp

Color Densitometer

Transmission Color in Lenses

Cameo Production Technique

Auditorium for Technical Meetings

Safety Requirements in Projection

Military-Type Lenses

American Standards

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SMPTE Engineering Activities

A report by F. T. BOWDITCH, Engineering Vice-President

THE ENGINEERING ACTIVITIES of the Society of Motion Picture and Television Engineers are much more extensive than perhaps most members realize. Engineering Committee reports appear in the *Journal* from time to time, but usually these give a detailed picture in a rather limited field rather than a broad view of the total activity. The frequent publication of proposed American Standards is another evidence of Society engineering activity, but this has sometimes created the feeling that the preparation of Standards proposals is the only activity in which the Engineering Committees of the Society are engaged. For these reasons, the writer has been encouraged to prepare this present report, designed to provide an overall picture which, while perhaps over-simplified in the particular details most familiar to any one reader, will at the same time give him information of general interest in other less familiar fields.

Editor's Note: This report, scheduled for some time for the *Journal*, now has special significance as a summing up by Engineering Vice-President Bowditch who, because of new responsibilities at the Research Laboratories, National Carbon Company, Cleveland, Ohio has found it necessary to resign before the expiration of his present term. He has served the Society as its Engineering Vice-President since January 1950.

Foremost in the engineering activities of the Society is of course the work of its Engineering Committees. From 1 to 75 pages of any individual *Journal* issue may be devoted to this field, and a check of *Journals* since January, 1950, shows an average of about 17 such pages per issue. This includes not only Committee Reports and the publication of proposed and final American Standards, but records of Convention symposia growing out of Committee deliberations on such widely different and often highly controversial subjects as preferred screen-viewing conditions, proposed magnetic film standards and 16mm emulsion position. A complete bibliography of Engineering Committee publications would thus be very extensive indeed, and much too long for inclusion here. For this reason, the references cited are confined to publications during the writer's term of office—except for a few much earlier ones of historical interest.

The Society prides itself on providing in these Committees a completely neutral atmosphere, without commercial bias, where the most active competitors can get together to work out their common problems. A more complete statement of the high regard in which the Society holds its responsibilities here will be found in the policy statement[1] published by the writer soon after assuming the Engineering

Vice-Presidency in January, 1950. It will be noted from this that while the Engineering Committees do determine appropriate test methods, and sometimes set limits characteristic of good performance, the Society is never permitted to become involved in the application of these to the comparative rating of competitive merchandise.

As has been implied, a major activity of the Engineering Committees is the determination of proposals to be recommended as American Standards. An American Standard can only be validated by the American Standards Association, according to a procedure which will be described later; but a great deal of spadework is required to reconcile competitive viewpoints and to phrase a proposal combining the resultant area of agreement with the technical accuracy necessary to a useful standard. In motion picture and related television fields, the spadework for a particular standard is done by one of the Engineering Committees of the SMPTE. This arrangement is a relatively recent one, and much simpler than before, as will be explained later. Also, since SMPTE as sponsor of ASA Sectional Committee PH22 is responsible for the general organization and work program of this Committee, the Engineering Vice-President is able to cooperate effectively within the ASA toward this same goal of a simplified Committee organization of maximum efficiency.

Particularly with the expansion of the Society's interests into related fields of television, possibilities for conflict developed between the agenda of SMPTE Engineering Committees and those of other technical societies. This soon led to the formation of a steering committee, which now bears the impressive title "Joint Committee for Inter-Society Coordination," and is composed of two delegates each from IRE, RTMA, SMPTE and most recently NARTB. The several committees of SMPTE in television fields have been set up with the knowledge and guidance of this group, and their agenda coordinated with those of potentially conflicting Committees of the other Societies represented. Here too an unnecessary burden was formerly placed upon many industries asked to contribute the time and expenses of technical employees to the Committees of several societies simultaneously engaged in solving what seem to be the same problems. It is the purpose of the JCIC Committee to eliminate such waste, at least among the member Societies. The Chairmanship of this group rotates among the eight members on an annual basis, each Society being represented in turn. Mr. Axel Jensen started things off last year as the IRE representative, while the writer is serving for SMPTE during 1952.

In the following paragraphs the origin and the work of each of the Society's Engineering Committees will be described in turn. From this it will be apparent that much besides American Standards proposals occupies these groups, and it is hoped that some useful measure of the important services rendered to the Society and to industry will be brought out.

Color

This Committee has been continuously active since its creation in 1929, and is thus one of the oldest committees of the Society. Dr. Herman H. Duerr of Ansco has just concluded two very capable terms as chairman, and has now been succeeded in this post by Dr. J. P. Weiss of Du Pont. The sixteen members of the Committee are chosen to represent the film and equipment manufacturers, as well as the studio users of color film. Although no American Standards have been needed recently in this field, the Committee has been actively concerned with such matters as a color process symposium, color sensitometry, color film sound

tracks, spectral requirements of light sources and projection screens and light-source color measuring instruments as applied to photography. A subcommittee under Lloyd Goldsmith prepared a very complete table on "Characteristics of Color Film Sound Tracks,"[2] and another subcommittee under Carl Overhage published an excellent 72-page treatise on "Principles of Color Sensitometry."[3] These two examples illustrate very well the important work in fields other than standardization which is being done by the Engineering Committees of the Society.

Curiously enough, the one proposal for standardization which this Committee has received in recent years was necessarily postponed until the trade situation is further clarified. It was pointed out to the Committee that several sorts of color film are presently on the market, each balanced for photography with an incandescent tungsten light source of a different color temperature. Standardization on a single color temperature would obviously provide for simpler stocking of film and of light sources, and so would seem a proper subject for consideration by the Committee; moreover, if the lower color temperature could be made standard, lamp life would be much prolonged. It was soon agreed, however, that standardization was not appropriate at this time because many economic factors remain to be clarified before the best balance between picture quality, film speed and light color and intensity can be determined. The Society has no right, nor in fact does it have the power, to force a single standard where substantial unanimity cannot be secured; nor are the facilities available to conduct extensive technical studies under Society auspices, and so assume the responsibility for securing the one best answer to a complicated problem such as this one.

C. Francis Jenkins, first president of this Society, gives excellent precedent for this present-day action in an address on "Society History"[4] delivered in 1918. Reporting an unsuccessful attempt "to adopt an alleged ideal specification for a projection machine" on account of the objections "by makers of diverse models," he concluded as follows:

"It did one thing, however, well worth while. It clarified the atmosphere and made more distinct to me and perhaps to others of us, the objects for which this Society was organized and even more strikingly the things for which it is *not* organized.

"For example, the Society of Motion Picture Engineers is not a judicial body to settle controversies between conflicting interests or to promulgate recommendations which make for class-discrimination. If our Society ever degenerates into a contest between factions each trying to use the Society for personal advantage, then our usefulness is ended and our organization will soon break up as others in the motion picture industry have already done.

"What we *did* organize for was to set our official seal on standards generally recognized as standards; and second, and perhaps best of all, to put into permanent form for world-wide distribution, the specialized knowledge which our members, experts in their particular line, are so unselfishly furnishing for this purpose. And while the official stamping of generally acknowledged standards is a necessary duty, for myself I have found the most interest in our meetings has come from the valuable papers read and printed, and I don't believe the limited time of our meetings can be spent in a more worthwhile manner."

Film Dimensions

This is a relatively new Engineering Committee, established in 1948 by the preceding Engineering Vice-President, John A. Maurer. The Society has been active in the field of film dimensions from the very beginning, however, as

witness the presentation by Donald J. Bell of a paper on "Motion Picture Film Perforation" at the meeting of October 2–3 in 1916, the second formal meeting of the Society. Bell's demand for standardization started a continuing activity, through first a "Committee on Cameras and Perforations" in 1916, then a "Committee on Film Perforations" in 1921, which continued as a subcommittee of the Committee on Standards from 1924 to 1948. In line with the philosophy of simplification previously expressed, the long-standing importance of film dimensions was once more recognized, and the former subcommittee was made a full-fledged Engineering Committee in 1948. Dr. Emmett Carver of Eastman Kodak has been the very competent Chairman of this group since its formation, the members representing the film manufacturing companies and those most concerned with the handling of film through apparatus in which dimensional tolerances are critical.

The biggest problems facing this Committee at present are those relating to the introduction of the new safety-type film bases. Film is ordinarily slit to dimension and perforated at the time of manufacture. After an indeterminate period of time, involving perhaps prolonged storage under various humidities and temperatures, and chemical processing, this film must pass smoothly and with great accuracy of positioning through a camera, printer, projector or perhaps some other sort of specialized film-handling equipment. The critical dimensions of these equipments have been chosen by long experience to match the characteristics of the old-style film base. Now, with new bases with different dimensional changes being introduced, the shoe is on the other foot: the film manufacturer must alter his initial slitting and perforating dimensions so that the dimensions in critical usage will be the same as before. American Standards for film dimensions presently "apply to the material immediately after cutting and perforating": the later dimensions at the time of film passage through an apparatus of some sort are of course known to be most important, but to date no one has been able to visualize a suitable procedure for extrapolating these back to the time at which the slitting and perforating is done.

Another problem of this Committee has been concerned with the possible choice of a single preferred shape for the sprocket perforation of 35mm positive and negative film. A proposal for this[5] has been forwarded to the Committee on Standards with the recommendation that it be made an American Standard.

Finally, a recent policy decision in the field of film dimensioning is worthy of notice. Not all film is slit at the time of manufacture. 16mm and 8mm film stock is sometimes provided double-width, to facilitate processing, with final slitting-to-width done after processing. For one reason or another, a good deal of the film made in this way has not been slit with the accuracy in width required to meet the American Standard dimensional tolerances, and poor sound reproduction, excessive picture weave and even film jamming in projection has resulted. The Committee considered the desirability of preparing a second and less rigid dimensional standard for 16mm film, to apply only to film slit from 35mm or 32mm stock after processing. This idea was soon rejected, however, on the basis that the present 16mm dimensional specification is required for interchangeable performance in all equipments, without reference to the manner in which the film is made. Thus there is no logical reason to let down the bars solely for the purpose of permitting all laboratory-slit product to qualify under a Standard of some sort. Since American Standards are not compulsory, a considerable market can and often is developed in nonstandard merchandise of all sorts.

It was concluded, however, that the demonstration of the existence of such a market is no reason to dignify it with a high-quality label.

Film Projection Practice

No matter what talent and expense have gone into the preparation of a fine motion picture film, the film must finally be projected with proper skill and good equipment in order to yield the proper end product. Projectionists and equipment manufacturers alike have always recognized this critical importance of high-quality projection, ever since this Committee was first established under the chairmanship of F. E. Richardson in 1928. Many will recall the fervent pleas for good projection practice which were a valued contribution of Mr. Richardson to the Convention sessions of more than a quarter century ago. He was perhaps more responsible than any other person for halting the early practice of referring to the men in the booth as simply "operators," and seeing to it that the more appropriate term "projectionist" came into common usage.[6] The torch is presently being carried by Ralph Heacock of RCA, who has recently succeeded M. D. O'Brien of Loew's in this important Chairmanship. A few years ago the word "Film" was added to the name of this Committee, in recognition of the advent of television projection in theaters, and the assignment of this latter aspect to the Committee on Theater Television.

The membership of the Committee on Film Projection Practice is presently composed largely of projection equipment manufacturers and theater circuit representatives, although we would like to add more projectionists to this group. An interesting agenda includes revision of the projection room plans, the possible preparation of projection room maintenance instructions, preparation of a proposed standard for arc-lamp mounting dimensions and the review of three American Standards dealing with projector aperture dimensions, basic projection room and lens dimensions and 35mm projection reels.

Films for Television

This Committee was first formed early in 1950, in line with the expanding interests of the Society in television fields. Previous to 1950, only two SMPTE television committees were in existence — one on Theater Television and one on simply Television. The latter became unwieldy as interests broadened, and so was divided into three Committees, on Films for Television, Television Film Equipment and Television Studio Lighting, respectively.

The Committee on Films for Television is chaired by Dr. R. L. Garman of General Precision Laboratory, and is staffed by film, equipment and television studio representatives. The committee is concerned with the special problems of film as used in television, and has been especially active in the field of "Television Test Films"[7] which has presented some very difficult problems, and in the preparation of a "New All-Purpose Film Leader"[8] by a very capable and energetic subcommittee led by C. L. Townsend of NBC. Other projects include a study of the problems concerned with pictorial quality of films for television use, and a study along with other Committees of the long-standing problem of 16mm emulsion position.[9] The reference noted should be consulted by those interested in this problem. The television picture and sound problems arising from the indiscriminate use of film for projection with emulsion sometimes facing the light source and sometimes the lens, was thoroughly discussed during the October 1951 Convention in Hollywood.[10] It was agreed then that it is up to the purchaser to specify and pay for the emulsion position he wants, and some television studios

report very good success in this way. The Hollywood symposium on 16mm emulsion position is worthy of special mention here as a typical example of an engineering service growing out of Engineering Committee activity.

High-Speed Photography

This Committee was first organized by Engineering Vice-President John A. Maurer in 1948, with John H. Waddell as Chairman and with a membership representing film and equipment manufacturers along with an excellent representation of the users of this very specialized equipment. Under Waddell, this group got off to a most energetic start, although more along the lines of a Papers Committee in its field, rather than with an agenda of engineering problems to be solved as is the case with the other Engineering Committees. In the papers field, the Committee on High-Speed Photography has sponsored technical sessions for one or more days at several Conventions and has published "A Survey of High-Speed Motion Picture Photography" and a "Bibliography on High-Speed Photography,"[11] while sponsoring the "High-Speed Photography Question Box."[12] A "Subcommittee on Technical and Engineering Society Liaison" was organized last year with representatives from about twelve other technical organizations, although it is too early to judge what may come from this attempt to correlate all technical-society effort in this field.

When John Waddell's permissible limit of two terms (four years) as Chairman terminated last January, we were fortunate in securing the services of Dr. Harold E. Edgerton of M.I.T. in this post. With the planning of an International Symposium on High-Speed Photography for the Washington meeting next October, the Committee is continuing its typically fast pace along this line.

Laboratory Practice

This is another of the Society's long-standing Committees, organized first as a committee on Laboratories in 1921, then Development and Care of Films in 1931, Laboratory and Exchange Practice in 1933, and finally as a separate Committee on Laboratory Practice since 1935. This Committee has never operated with more energy and effectiveness than during the last few years under the Chairmanship of John Stott of Du-Art Film Laboratories. Membership is recruited largely from the processing laboratories, as the title would suggest.

Projects of this group include the determination of a standard screen brightness for 16mm review rooms, so that the customer and the laboratory may judge the product on an agreed common basis. Difficulties presently arise here on account of the conflicting demands of the Armed Services for thin prints to be projected at low light levels, and the need for dense prints for the amateur's small, beaded screens and 1000-watt projection lamps.

The standardization of printer cueing devices is another project of much potential value. Negatives circulate widely between laboratories and since there is no present agreement respecting these cueing devices, much patching and mutilation of the film results.

Emulsion position with 16mm positive films has also been discussed long and often by this group. Here too it is concluded that no single standard will ever be observed until the customers apply the necessary pressure and agree to pay the extra cost where this is involved. Standard magnification ratios when printing between 35mm and 16mm film sizes, and assistance to the Armed Services in setting up better specifications for print quality are other problems. The recent establishment of a Chemical Corner[13] in the *Journal* is

another important service provided by this Committee.

Motion Picture Studio Lighting and Process Photography

A Society committee on Studios was first organized in 1917, followed by one on Studio Lighting in 1928, which has operated continuously since that time. The term "Motion Picture" was added to the Committee title in 1950 to distinguish this from the newly created Television Studio Lighting Committee. A former Committee on Process Photography was combined with the Studio Lighting Committee in 1951, following a six-year period of carrying the former on the books as "under organization," with little evidence that such organization was really needed.

This illustrates another basic principle of Engineering Committee operation. These Committees come and go — and perhaps return again — as the needs of the industry require. There is never any intention to carry a Committee simply as a listing of names in the *Journal*, and such a listing is terminated as soon as reasonable efforts to stimulate activity prove unsuccessful. Activity solely for activity's sake is never encouraged; but if there is useful work to be done, every effort is made to enlist competent persons to do it.

M. A. Hankins of Mole-Richardson has recently concluded a very competent two-term maximum as Chairman of the Committee on Motion Picture Studio Lighting and Process Photography, and he is now succeeded in this post by John W. Boyle, Director of Photography. This group is based in Hollywood, and is composed of studio lighting equipment representatives and persons who are concerned with set lighting. Since the proper use of lighting is largely a matter of art, the field of the engineer is limited here. In spite of this, the Committee regularly prepares comprehensive reports[14] which are most useful in acquainting the industry with the latest things in set illumination equipment and their studio usage.

Another motion picture studio group, the Committee on Cinematography, also based in Hollywood, was temporarily inactivated a year ago, after no interest had been manifest for a considerable number of years.

Limited West Coast activity in Society Engineering Committee work is no doubt in part the result of basing the Engineering direction almost 3000 miles away, in the New York headquarters of the Society. Another factor, of course, is the fine work of the Motion Picture Research Council and of the American Society of Cinematographers in related fields. The Society enjoys the best possible cooperation with these organizations, and of course has no interest in attempting to duplicate their work. Nevertheless, the Engineering Vice-President has repeatedly felt a sense of responsibility to encourage more activity in the West Coast committees which are part of the traditional engineering organization of the Society. Any suggestions here will be most welcome.

Optics

Reference to the first volume of the *Transactions* of our Society indicates a very early interest in the subject of optics, a Committee on Optics having been formed in October 1916 and remaining active through 1923. From 1930 through 1934 a Committee on Projection Theory was concerned with this field, but this was absorbed by the Committee on Standards in 1935. Finally, a subcommittee of the Committee on Standards was once again given full committee status in 1950 with the establishment of the present Committee on Optics. Dr. R. Kingslake of Eastman Kodak has served as Chairman since that date.

The first major assignment of this Committee has been the preparation of a proposed standard for the photometric calibration of camera lenses. The group

has agreed on two methods, either of which gives accurate results. A recommendation has also been submitted respecting the standardization of an associated lens marking system in so-called "T-stops," but this portion of the proposal is finding considerable opposition from those who feel that the validation of a T-stop lens marking method will lead amateurs to expect a greater exposure accuracy than will likely result. The Committee has done a very excellent technical job in specifying accurate calibration methods, a procedure which has been much facilitated by the generosity of the Radio Corporation of America in granting licenses under a patent issued to L. T. Sachtleben of RCA. If the T-stop versus *f*-stop controversy proves insoluble, it is hoped that the test methods can in some way be made standard, independent of the provocative term "T-stop."

Other projects of this group include the specification of lens mounting dimensions for 35mm, 16mm and 8mm film projectors, and standard lens resolution test procedures.

Screen Brightness

The present Screen Brightness Committee dates back to the Committee on Theater Engineering of 1941. This latter Committee consisted at that time of a combination of several subcommittees, including one on Screen Brightness. This subordinate status continued through 1945, after which the several subcommittees of the Theater Engineering Committee were each given full Engineering Committee status. Dr. W. W. Lozier of The National Carbon Company is the present Chairman of this very active group.

A major activity here has been the screen brightness survey,[15] which has now been extended to cover 125 indoor theaters and 18 West Coast 35mm review rooms. Much helpful information has been secured, and this is being extended to include a representative number of drive-in theaters. An important aspect of this work has been the specification of a suitable light-measuring equipment and method of use.

A symposium on screen viewing factors[16] was sponsored by this Committee, providing not only a most instructive Convention session but also more than 50 pages of technical papers in the *Journal*. The great importance of these screen viewing factors is fully recognized by the Committee, which is presently working to stimulate commercial interest in the psychological test procedures required to get the audience reaction data needed.

A basic problem in standardization recently developed when a question arose respecting the omission of drive-in theaters from the American Standard specification of screen brightness ($10^{+\frac{1}{2}}$ ft-L). No commercial projection equipment can presently supply, nor will present film withstand, the quantity of light required to illuminate large drive-in screens to this level. So, no matter how good his intentions, the owner of a drive-in can only meet the present American Standard by cutting the size of the screen and the capacity for customers to an impractical extent. Rather than give a "nonstandard" label to all the drive-in theaters in the country, the Committee therefore voted to omit them altogether from the specification. This is in line with the basic principle that an American Standard should be a commonly accepted practice, capable of realization in a commercial way, and not simply a theoretical quality goal for the indefinite future.

The Screen Brightness Committee now has active Subcommittees on: Meters and Methods of Measurement, Projection Screens, and Illumination Practices.

16mm and 8mm Motion Pictures

This group was first organized as the Committee on Nontheatrical Equipment in 1931, assuming its present title in

1946, in recognition of the growth of 16mm usage to include important theatrical as well as many other significant high-quality applications. Because there is much less film area than with 35mm film on which to record picture and sound information, the 16mm engineers are encouraged to seek the best possible quality in all their operations. Learning in this way what careful attention to quality can produce, these engineers have made of this Committee a very active forum for the exchange of ideas and information, and an effective influence for higher quality in all phases of the industry.

This interest in all phases calls attention to the fact that this Committee is the only one set up along product rather than along process lines, so that opportunities for conflict with the work of the other committees frequently arise. For instance, problems in 16mm film dimensions, laboratory practice, sound, etc., might equally well be handled by the committees in these particular fields. This situation has developed from the early days when 16mm was regarded as "substandard," and no one even thought of 8mm film. 35mm sound engineers, as an example, had no interest in 16mm, so that two entirely different groups of people were required to represent those interested in the 35mm and 16mm applications respectively. Now that this is no longer true, tradition and a very active record of accomplishment have operated to maintain a committee which would probably not be reorganized at all if we were to ruthlessly start over again in the light of the present-day committee arrangement. However, no Society would be foolish enough to disband or even to limit the work of a group as active and as useful as this one continues to be.

This Committee in recent years has done an outstanding job of developing American Standards proposals, a total of approximately 20 being presently in various stages of negotiation through final confirmation. Much of this has come from intensive work with the Armed Services during World War II, directed toward the determination of a JAN (Joint Army-Navy) specification for a 16mm projector.

In addition to being the most active Committee in the development of standards proposals, the 16mm and 8mm group is working on recommendations for 16mm review rooms, especially sound reproducing equipment, a test film for checking the resolution of projector optical systems, and the preparation of a booklet on 16mm and 8mm Projection Practice.

The Committee has been faced with many difficult standardization problems, in some of which unanimous trade agreement has been impossible to achieve. The familiar one of 16mm emulsion position is an outstanding example; although an American Standard does exist here, this is frequently ignored and serves mainly to demonstrate the futility of a Standard which does not have the acceptance of all concerned. Another classic case is the specification of the guided edge in several standards dealing with 16mm film. Projector manufacturers were not in agreement in their choice of the sound-track versus the perforated edge, since good design reasons existed for either one. Now, however, a reversal of the earlier majority opinion is in prospect, on account of the prevalence of increasing amounts of substandard 16mm film, inaccurately slit from 32mm or 35mm after processing, and so providing a very inaccurate reference edge for the positioning of the picture and sound-track areas.

Present-day difficulties in arriving at a standard here are reminiscent of Mr. Jenkin's experiences with the first standardization efforts of the Society, which were previously quoted. Standards defining a preferred design for quality reasons create many debatable issues, and these should ordinarily be left for independent resolution by each

designer, where critical interchangeabilities are not involved. Let the Society specify standard test methods, including test films, so that the customer may determine matters of relative product quality in a reliable manner; but let us avoid labeling any particular product as substandard except where critical interchangeability is involved, or complete unanimity achieved.

A final example of this kind is the effort made in 1948 to revise an earlier American Standard for 16mm sprocket design, including features intended to insure better quality rather than simply interchangeability. Sprockets of a design different from that of the proposed standard were stated by a major manufacturer to be in wide successful use, and his engineers did not agree that the design proposed as standard was any better than this. Further, to quote E. W. Kellogg[17] ". . . if a manufacturer puts out a machine which performs well with a standard film, and the film is not subjected to undue wear, and his customers are happy . . . it is no one else's business what shape tooth he uses." Thus the difficulties first experienced by Mr. Jenkins returned to trouble us once more. In the sprocket case, the Committee on Standards adopted a form of recommendation, which would permit competent technical material of this sort to be published in an authoritative manner for the general education of the industry, while at the same time avoiding the application of a nonstandard label to all other designs. This form of publication[18] is reserved for standards proposals which fail to secure the unanimity necessary for standardization, but which do embody much good technical material, thought to be of general trade interest.

Henry Hood of Eastman Kodak has just concluded a very capable 4-year term as Chairman of the 16mm and 8mm Motion Pictures Committee and has now been succeeded by Malcolm Townsley of Bell & Howell. The large membership of 23 persons reflects the wide range of interests represented.

Sound

When talking motion pictures arrived with startling suddenness in the late 1920's, they brought many technical problems, and with them, the creation in 1930 of the SMPE Committee on Sound. This is presently the largest of all the Engineering Committees, including 27 persons with the Chairman (West Coast) and Vice-Chairman (East Coast). Representatives of the 35mm studios, the 16mm and 8mm industries, and television combine with the sound equipment, film and magnetic tape suppliers to give a very complete coverage of the field. Lloyd T. Goldsmith of Warner Bros. has just completed four very competent years as Chairman, and he has now been succeeded by John Hilliard of Altec-Lansing — also of Hollywood. Glenn Dimmick of RCA continues as Vice-Chairman in the East, and in his Chairmanship of the very important Magnetic Subcommittee.

Major problems in this group have to do with standardization, particularly respecting magnetic sound. A very important symposium respecting magnetic film standards was sponsored during the Hollywood convention last October[19] giving opportunity for a very frank and open presentation of the opposing viewpoints. Here is a case where the need for a single standard was recognized by all concerned, although each conflicting system had been chosen by its sponsor for reasons thought to be valid. The invaluable opportunity offered by the Society as an impartial meeting ground for active competitors is well illustrated here, and there is every reason to anticipate the early determination of the single standard needed.

In addition to active work on many standards, the Sound Committee does

a great deal of work on test films, being presently concerned with the specification of new ones related to magnetic sound.

Standards Committee

This is the most venerable and honorable of all the Engineering Committees, going back to the very early days of the Society. Standardization in the first years was "Adopted in Committee of the Whole Society," as witness the first "Motion Picture Standards" published in the first volume (1916–1920) of Society *Transactions*.[20] These apparently resulted from the recommendations of one of the four engineering committees of that time, in fields of Cameras and Perforations, Motion Picture Electrical Devices, Projection Machines, and Optics, respectively. In 1924, a Committee on Nomenclature and Standards was formed, this being changed to the present title in 1934.

For many years, standardization proposals were developed by subcommittees of the Standards Committee, by subcommittees of ASA Sectional Committee PH22 on Motion Pictures and by any one of the several Engineering Committees of SMPTE. This finally led to the realization that the most competent people in particular fields have already been brought together in the respective Engineering Committees of SMPTE, so that it is most efficient to refer all Standards work projects directly to these Committees, rather than to appoint members of these same Committees as a subcommittee of the Standards Committee or of ASA Sectional Committee PH22.[21] This procedure was first inaugurated by John A. Maurer and was further facilitated by his appointment of all Engineering Committee Chairmen as members of the Standards Committee. The balance of the Committee serves ex officio, and includes a representative of the Motion Picture Research Council, the chairman of ASA Sectional Committee PH22, the Past Engineering Vice-President of SMPTE and the Past Chairman of the Standards Committee. This insures a most competent and experienced group of engineers, well qualified to handle the policy-type matters which come before it, along with the processing of standards proposals. While the basic policies which are cited as examples throughout this report are the responsibility of the Engineering Vice-President, these are in general the result of discussions with the Standards Committee, and the determination of a consensus there.

The dean of the motion picture standards business is generally recognized to be Dr. Emmett Carver of Eastman Kodak, who served as Chairman of this Committee for many years. Dr. Carver brings a very fine attitude of patience, impartiality and technical thoroughness to these deliberations, and his capabilities are universally respected by those who work with him in this field. Frank E. Carlson of General Electric has just completed a competent four-year term as Chairman of the Standards Committee, and has now been succeeded by Henry Hood of Eastman Kodak. Hood's recent appointment to fill the remainder of the current Engineering Vice-President term creates a vacancy here which has not been filled at this writing.

Stereoscopic Motion Pictures

The April 1952 *Journal* was the first to list this new Committee, formed since the first of this year. Started a few months ago as a task force to report on the extent of trade interest in the formation of such a permanent Committee, the group found the response was immediate and very enthusiastic. John A. Norling is the ambitious Chairman of this new Committee, and while it is too early to predict the relative importance and permanence of this group, present indications are certainly favorable. Two projects presently under way are concerned with stereoscopic

nomenclature and with the preparation of a bibliography of this field.

Joint RTMA-SMPTE Committee on Television Film Equipment

This Committee is an outgrowth of negotiations in the Joint Committee on Inter-Society Coordination. As previously noted, the SMPTE realized late in 1949 that television interests in the Society had grown too large to be contained within the Committees on Television and on Theater Television. The latter was specific enough, but the handling of all other interests in a single Committee on Television was no longer practical. A few months prior to any definite action by SMPTE, the RTMA independently realized the need for technical committee activity in the field of television film-handling equipment, and so formed a very capable Subcommittee of Subcommittee 4 of RTMA Committee TR4, bearing the designation TR4.4.2. Thus, while SMPTE was making up its mind, the independently conceived RTMA Sub-Subcommittee came into being, squarely in one of the fields contemplated by SMPTE, and immediately gave evidence of energetic competence. The individual members of the RTMA committee might just as appropriately have been serving with SMPTE, since the same commercial organizations and most often the identical persons are the ones most logically chosen whenever a competent Engineering Committee is formed in a specific field such as this one. As an example, seven of the twelve-man TR4.4.2 Committee were already SMPTE members, including the Chairman. Thus it was quite impractical for SMPTE to attempt the formation of an altogether different Committee to do this same job, even though this was obviously in a technical field where the Society was most expert. Hence the formation of the coordinating Committee, and the agreement with RTMA that this would henceforth become a joint committee of the two Societies. Details remain to be worked out, since the formal procedures respecting membership appointment and chairman selection are not the same in the two sponsor organizations. Here too the JCIC will prove helpful.

Dr. Frank N. Gillette of General Precision Laboratories continues as Chairman of the Joint Committee, with Dr. E. C. Fritts as Vice-Chairman, representing SMPTE. To the original membership of 12, appointed by RTMA, SMPTE added six more, from film and film equipment agencies not previously represented. A major project of this group is the preparation of a 16mm projector specification, incorporating the special requirements of television usage. Other projects include a standards proposal for dimensions of slides and opaques, and one for picture dimensions on 16mm and 35mm motion picture film.

It should be mentioned here that among the new Committees originally considered by SMPTE in the field of television was one on Video Recording, listed as "under organization" in the April, 1950, listing of Committees of the Society. In discussions of this in the JCIC, it was agreed that aspects of this operation of interest to SMPTE would properly come before the Committees on Film for Television and Television Film Equipment. The SMPTE Committee on Video Recording was thus allowed to disband before the organization phase was completed. An IRE Subcommittee on Video Systems and Components is in potential conflict here, but it has been suggested through the JCIC that this latter group do no work on film handling equipment.

Television Studio Lighting

This is another of the new television committees resulting from the expansion of the old Committee on Television. Since this field is not in potential conflict with the technical committee work

of the IRE, RTMA and NARTB, this has been agreed to be outside the field of interest of the JCIC.

The Society has, however, been engaged in a running argument with The Illuminating Engineering Society respecting duplication of effort here, which was resolved for a while by an IES agreement to leave this to SMPTE, while working in IES with the lighting problems associated with television viewing. This agreement has since been abandoned, however, so that two separate technical committees of quite similar membership presently exist in the field of television studio lighting, one sponsored by SMPTE and one by IES. We have recently explored the possibility of reducing this to a single Joint Committee of the two Societies, as with Television Film Equipment, but this has so far been unsuccessful, and further efforts have now been abandoned.

It has been accepted as a basic policy of the SMPTE Committee that only those projects shall be undertaken which are of admitted interest to the television studio engineers. Equipment makers and other suppliers of the studios are in the minority on the Committee, and serve primarily as sources of information.

Richard Blount of General Electric is serving his second term as Chairman of this Committee, and is presently active in promoting the chosen Committee objectives of: (1) defining means for the measurement of television studio lighting, both incident and reflected; (2) terminology; and (3) the possible standardization of electrical plugs.

Test Film Quality

This Committee was first organized in 1944, in order to provide expert advice respecting the maintenance of proper quality of the Society's test films.

Responsibility for defining the content of one of these test films lies ordinarily with the Engineering Committee most concerned, as does the suggestion of new test films as their need becomes apparent. The Quality Committee, on the other hand, sees to it that appropriate controls are devised and maintained to insure that the films made are in accordance with these specifications. With the full time employment of Fred Whitney about one year ago, Society headquarters facilities for test film quality maintenance have been much augmented.

The present Chairman of this important Committee is Fred Pfeiff of Altec Service Corp., who is exceptionally well acquainted with test film quality considerations from the user's standpoint. The Committee membership consists of persons expert in the processing of high quality film, including a representative of the Motion Picture Research Council.

Theater Television

This Committee was first organized in 1944 as a Subcommittee on Television Projection Practice of the Committee on Theater Engineering, acquiring the present title of "Theater Television" in 1948. The group has operated to date largely as a policy Committee, and for the purpose of assembling and distributing technical information of interest in this important new field. The Society has also appeared before the Federal Communications Commission, presenting data secured through this Committee relating to the nature of the facilities thought necessary for a theater television distribution system.[22]

Largely as the result of the stimulation provided through this Committee, many business groups became actively interested in theater television, and these have also appeared with increasing enthusiasm before the FCC in support of this new medium. Finally, it became apparent that the services of the Society were no longer needed to plead this cause, and the Theater Television Committee recommended that the Society

make no further appearances before the FCC since "the new industry is well able to solve its own *commercial problems*." The statement "Theater Television and the FCC,"[23] should be consulted for further details.

It is anticipated that this Committee will some day be concerned predominately with the engineering problems arising from the operation of television projection equipment in theaters. Consideration is also being given to undertaking a study of color television systems as applied to theater use. For the moment, things must stand by until the oft-postponed FCC hearings are out of the way, since these must occupy the first interest of many of the Committee members. Results of these hearings will also have an important effect on the future field of interest of the group.

Paul J. Larsen was the chairman of this Committee during the very important formative years from 1945 to 1948, and his missionary enthusiasm did much to keep the spark alive when commercial interest waned. Donald E. Hyndman took over in 1948 and brought Larsen's early work up to the point where trade enthusiasm became so great that no further Society participation before FCC was needed.

George L. Beers of RCA is the present Chairman, and in talking his assignment over with the Engineering Vice-President and with Mr. Hyndman (who was forced to resign on account of the pressure of other affairs) the following general field of operation was agreed upon:

"In general the Theater Television Committee should concern itself with the study of the *engineering* factors involved in the production of theater television programs. Rather than attempt to prescribe the minimum picture quality which a theater television screen image must provide in order to be a sales-worthy product, the Committee should indicate the engineering requirements of systems of different quality. In this way the theater industry can have the technical information needed on which to base its own course of competitive action.

"It was pointed out, however, that in spite of our intent to operate primarily as an engineering group, the crystal-gazing aspect might, nevertheless, be requested of us by the FCC. In such an event, an opinion would of course be determined, but in such a way as to distinguish it clearly from the factual engineering data which are to be the main concern of the Committee."

Theater Engineering

Society committee work in this field has been carried on from the very beginning, starting as a Theater Equipment Committee in 1916. From 1940 to 1945 the Theater Engineering Committee provided general directional responsibility for several major Subcommittees which later became full fledged Engineering Committees, i.e., Projection Practice, Screen Brightness, Television Projection Practice, etc. The Committee on Theater Engineering Construction and Operation was one of these to become separately established in 1946, with this long title shortened to the present one of simply Theater Engineering in 1949.

Leonard Satz of Raytone Screen Corp. served capably as Chairman of this Committee, starting in 1948; the present chairman is J. W. Servies of National Theater Supply. Projects studied by this group include theater carpets,[24] air-conditioning, size and mounting characteristics of theater screens, and theater codes. A correlation of the latter as among the several states and cities would be of very great service to industry, and might promote worthwhile standardization.

Thus is concluded the description of the 18 Engineering Committees presently operating for the SMPTE.

Further along engineering lines, the Society is a member of the Inter-Society Color Council and is represented there by a delegation of which Ralph M. Evans of Eastman Kodak is Chairman. Society representation is similarly provided on the U.S. National Committee of the International Commission on Illumination, with Ralph Farnum of General Electric as Chairman. The most extensive of these extra-society engineering activities, however, is that with The American Standards Association, this being discussed in the following paragraphs.

American Standards Association

This is an association of standardizing bodies in many fields of industry, sponsored by industry, and issuing so-called American Standards. These Standards do not of themselves have any force in law, but are generally recognized as representing best practice, and so are frequently incorporated in purchase specifications by agreement between individual buyers and sellers. Elaborate safeguards are provided in the preparation of these standards, insuring the very careful review of all standards proposals by a sequence of authorities terminating in a Standards Council. Provision is also made for the periodic review of all existing American Standards so that obsolete material does not remain on the books.

Standards in the field of motion pictures and in those aspects of television assigned the Engineering Committees of SMPTE are processed through ASA Sectional Committee PH22 on Motion Pictures, presently under the chairmanship of Dr. D. R. White of Du Pont. This ASA Committee is authorized to consider proposals received from any reputable source, but, in practice, almost all of these originate in SMPTE or in the Motion Picture Research Council. In line with the simplification previously discussed, Committee PH22 seldom conducts a technical study in the entire Committee, since the representation is necessarily so broad that adequate technical coverage of any one specialized field is not possible. Subcommittees used to be created to enlist such talent as needed, but this is now handled through the Engineering Committees of SMPTE. Thus with respect to the processing of American Standards, Committee PH22 is largely a policy group, concerning itself more with the need for a particular standard and whether or not an adequate consensus has been reached, rather than with the technical content.

With the recently increased interest in world standards through Technical Committee 36 on Cinematography of the International Organization for Standardization (ISO/TC36), PH22 has now assumed an important new responsibility. The Secretariat of this International Committee is held by the ASA, and the responsibility for expressing the U.S. viewpoint, both respecting world standards proposals and in replying to the proposals of other nations, naturally channels through PH22. Policy matters are decided there, and technical studies requested of the SMPTE Committees where needed. The first international meeting of ISO/TC36 was held in New York City on June 9, 10 and 11, 1952, with PH22 playing an important part in heading the U.S. delegation. U.S. proposals for consideration as International Standards were first recommended by the Engineering Committees of SMPTE, and the Chairmen of the committees concerned with these recommendations were included in the U.S. delegation headed by Dr. White. The Engineering Vice-President of SMPTE was chosen as chairman of this first formal meeting of ISO/TC36, and is most appreciative of having been given this opportunity to work with this very sincere and highly cooperative group. Delegates from Belgium, France, Germany and the United Kingdom worked with the U.S.

group here to achieve substantial unanimity respecting a much greater number of so-called Draft Proposals than anyone had thought possible.

Committee PH22 derives its authority from two sources. First, the Committee is "sponsored" by the SMPTE. This is a conventional arrangement, typical of many other ASA Sectional Committees. The sponsor is responsible for the agenda, and submits his recommendation to ASA respecting the chairman. He is ordinarily required to supply secretarial service, which is very capably done for PH22 by the very versatile Henry Kogel, SMPTE Staff Engineer. Kogel is unusually well fitted for this task, since he also serves as secretary for all the Engineering Committees of SMPTE, previously described.

Within the ASA structure, Committee PH22 is one of five Sectional Committees under the general jurisdiction of a Photographic Standards Board (PSB), of which Paul Arnold of Ansco is the Chairman. The other Committees in this group are:

PH1, Photographic Films, Plates and Papers;
PH2, Photographic Sensitometry;
PH3, Photographic Apparatus; and
PH4, Photographic Processing.

These four represent divisions of the earlier ASA Sectional Committee Z38 on Photography, which became too cumbersome in its operations to continue as a single group. When this reorganization of Z38 into four separate Committees was under consideration by the ASA, the creation of a new correlating Board was also proposed, to which these new PH committees would report in a manner conventional in the ASA with other groups. The SMPTE was asked to agree to a revision of the then independent status of ASA Sectional Committee Z22 on Motion Pictures, so that it too would report to the new correlating Board. This was agreed to, and the designation accordingly changed from Z22 to PH22. Objections were raised at the time to inserting another in the long chain of reviewing agencies between the technical working body on the one end and the Standards Council on the other. However, SMPTE received assurance from the ASA that this was purely an organizational detail within ASA, and that the new Correlating Committee would exercise no significant authority over the affairs of PH22. Correlation is naturally required at some stage to prevent possible duplication of effort between PH22 and the four other PH Committees, and this the new Photographic Standards correlating Board does with very good effect all around. Thus while the rules of procedure of the ASA give correlating Boards in general the right to exercise a considerable degree of authority, this is frequently not used, and it is anticipated that the existence of the PSB will have little effect on the operations of PH22, so long as the SMPTE does a competent job as sponsor.

This then is the present picture of the activities in which the Engineering Vice-President represents the interests of the SMPTE. It is a continual pleasure to work with such a fine, cooperative group of technical people, and particularly with the very refreshing international experience with ISO/TC36 so clearly in mind, it seems altogether tragic and unnecessary that similar progress is not made along political lines. The scientists, however, are showing an ever increasing concern in the study of human reactions, for example in their interest in many phases of the science of color, and the determination of preferred motion picture viewing conditions — so they may yet bring their talents and impartial scientific viewpoints to bear on the troublesome social problems of the world. Having seen the fine cooperative give-and-take in our many Committees, with

axe-grinding at a negligible minimum, one is at least led to hope.

Finally, I wish to express my great indebtedness to the several Chairmen mentioned previously, and to the almost 300 Committee members, whose unselfish cooperation has made this work possible; also, to Society headquarters where Boyce Nemec maintains a most efficient organization and Henry Kogel strives manfully and with very good effect to keep on top of his even score (or is it more?) of secretarial responsibilities. The contribution of my own employer, The National Carbon Company, in granting me the time and expense monies necessary to the conduct of this very pleasant work, is also gratefully acknowledged.

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Explosive Argon Flashlamp

By C. H. WINNING and H. E. EDGERTON

Oscillographic measurements of the light output from argon explosive flashlamps show that the flash duration is about 1 μsec for a 0.5-cm thickness of argon over the end of a cone of cast pentolite 2 in. in diameter. The peak light output is about 200 million cp, and the total output about 200 cp secs. Photographs of the argon lamps were made with a magnetooptic shutter having an effective exposure of about 1 μsec to show the space origin of the light.

THE PHOTOGRAPHY of detonations by means of an ordinary single-exposure camera has been difficult to accomplish for two reasons. First, either the light from the detonation of high-temperature explosives is so actinic as to fog the film; or the light from the detonation of relatively low-temperature explosives such as those of the permissible, coal-mining type, for example, is insufficient to affect the film in the brief exposure time required to stop the motion. Second, although conventional short-flash electronic flashlamps might be considered for some purposes, their use is expensive because the lamp is destroyed by the explosion.

The second difficulty may be overcome, for problems where the subject is not excessively large, by the use of another explosive to produce light at the proper time. A relatively inexpensive, expendable, flash-producing, explosive-activated lamp is described here. The objects of this paper are, first, to present oscillographic measurements of the light output from an argon-filled explosive flashlamp and, second, to present sequence photographs of the exploding lamp itself for correlation with the oscillograms.

Successful photography of self-luminous subjects may be accomplished by the use of Kerr cells, Faraday-effect shutters, and by image-converter tubes. The series of photographs published here of the explosive argon flashlamp during explosion were taken with the Rapatronic shutter (Faraday magnetooptic type).

Presented on April 23, 1952, at the Society's Convention, at Chicago, Ill., by C. H. Winning, E. I. duPont de Nemours & Company, Explosives Dept., Eastern Laboratory, Gibbstown, N.J., and H. E. Edgerton, Massachusetts Institute of Technology, Electrical Dept., Cambridge 39, Mass.

Argon Flashlamp

In 1937 Michel-Lévy and Muraour published a series of pictures which illustrated that rapidly occurring events, such as the deformation of a lead block by an explosive, could be photographed at desired instants during the process through proper use of the short, intense

luminosity of the shock wave generated in argon gas by a small amount of a brisant explosive.[1]

Shock-wave flashes of about 4- to 20-μsec (4 to 20 × 10^{-6} sec) duration and 300–600 million cp intensity were produced by detonating 0.4–5.0 cm^3 of a brisant explosive (tetranitromethane plus toluene) in the end of a small, grooved brass cylinder, above which was a cellophane tube filled with the argon. The cellophane tube and the brass cylinder had the same diameters, namely 8 mm or more. The vertical cellophane cylinder of argon traversed by the luminous shock wave had a height of about 8 cm.[2,3] Apparently the selected materials and dimensions favored the production of brief, intense luminosity.

Later investigators who employed the argon flashlamp in photographing various explosive phenomena used modified forms of the lamp. Shepherd reported use of a lamp consisting of approximately ¼ oz of pressed tetryl inside a cardboard cylinder 2 in. in diameter. The end of the cylinder had a cellophane window.[4] The duration of luminosity of the flashlamp was estimated to be 2–4 μsec. The pictures, which were taken by either front or back lighting (silhouette), illustrated that the light from the argon flashlamp, even though spread over the expanse of the subject at different selected stages in the explosion process, was much more brilliant than the hot gas from the permissible-type explosives. U.S. military investigations during World War II included photographic studies of underwater explosions, which required the development of lamps suitable for (1) the illumination of gas bubbles from explosions at different depths and (2) the illumination of relatively small, high-velocity, demolition explosives detonating relatively near the camera. In order to obtain flashes of high intensity and short duration, attention was given to both the surface area of the charge generating the shock wave at a given instant and to the thickness of the argon layer traversed by the shock wave. Both spherical and conical cast pentolite charges were employed.[5] It was found that both the duration and the intensity of the illumination increased with the thickness and the area of the argon gas layer, but details about the methods and results have not been published in the open literature.

The present paper includes microsecond photographs and oscillograph reproductions which show the characteristics of the brief flash of intense light developed by a conical explosive charge in an experimental type of flashlamp used at Eastern Laboratory.

Experimental

Photographs of the argon flashlamp were made with a one-microsecond Rapatronic shutter.[6] The shutter is triggered by the light from the explosion by means of a photoelectric cell (RCA 929) and an adjustable time-delay circuit.

The Rapatronic shutter consists of crossed polarizers between which is a slug of extra-dense flint glass as shown in Fig. 3. The shutter is opened by causing the plane of polarization to rotate in the glass (Faraday effect) by an axial magnetic field.

The 1-μsec exposure is produced when a 24-kv, 0.125-μf capacitor is discharged through a triggered air gap into a nine-turn coil around a slug of extra-dense flint glass 1 in. in diameter. The plane of polarization of the light passing through the glass is rotated by the magnetic field. A doublet camera lens of about 6-in. focal length was used in front of the Rapatronic shutter. Visual focusing was accomplished by rotating one of the polarizers that normally are crossed on opposite ends of the flint glass.

The light-time oscillographic trace was displayed on a Du Mont Type 256A ranging oscillograph, and a photograph was made to record the transient. Light from the argon explosion was allowed to fall on the cathode of an RCA Type 929

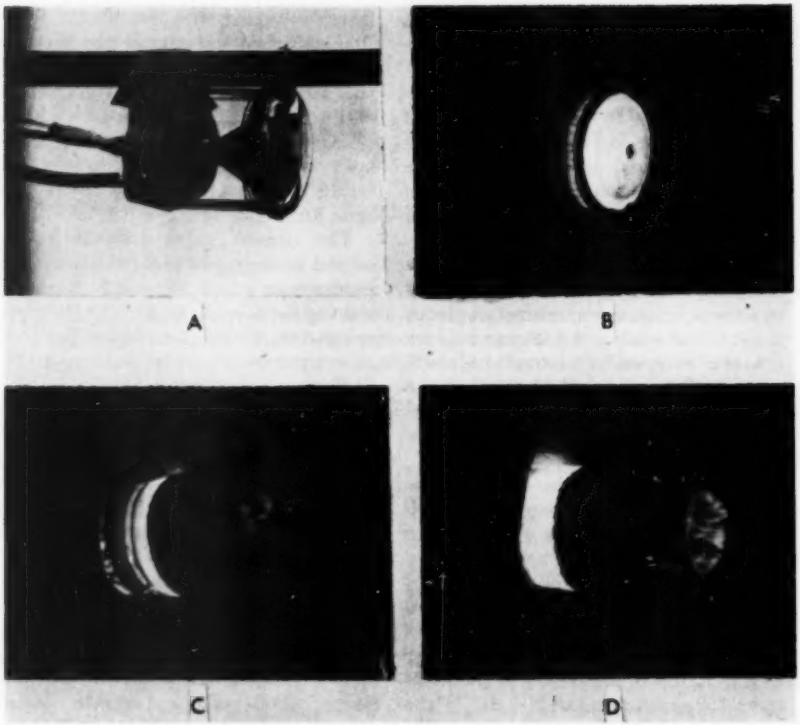

Fig. 1. Explosion of argon flashlamp.

A. Lamp with watch glass 0.5 cm ahead of conical pentolite charge. "Primacord" initiator and argon gas line are at rear.

B. Frontal lamp flash about 0.5 μsec after attaining maximum intensity.

C. Condition about 3 μsec after maximum flash.

D. Condition about 7 μsec after maximum flash.

phototube (S4 cathode) which had a 1000-ohm load resistor and a plate supply of 2000 v. The high plate voltage was necessary to assure that current and light were proportional at the large values of current. The time constant of the output circuit was estimated to be less than 0.1 μsec.

Calibration of light deflection was made by the use of a General Radio Strobolume which produces about 10 million peak beam candlepower.

The explosive flashlamp (Fig. 1A), whose performance is reported in this paper, consisted of a 2-oz conical, cast pentolite (50–50 PETN and TNT) charge within a 2.5-in. diameter glass tube containing argon. The front of the conical charge (contained in a glass funnel) was curved to conform with the curvature of the watch glass sealed over the front of the lamp. The desired 0.5-, 1- or 2-cm spacing for argon between the explosive charge and the watch glass was fixed by using a spacer made from a thin gelatin capsule. The pentolite charge was initiated at the rear apex of the cone by means of the "Primacord" detonating

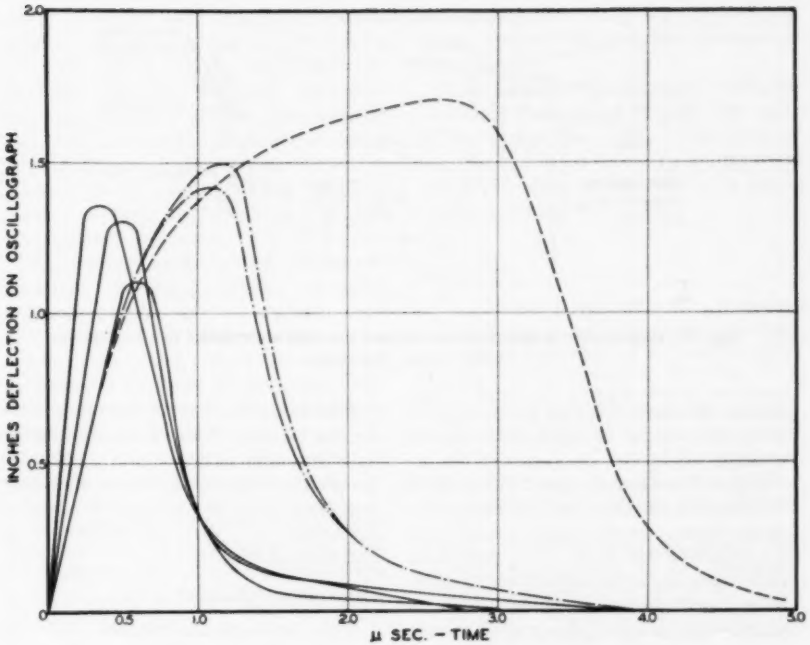

Fig. 2. Luminosity-time curves for argon flashlamps.

Symbol	Thickness of argon layer at front of lamp, cm
———	0.5
—·—	1.0
- - - - -	2.0

fuse which entered the charge through the stem of the funnel. The air in the lamp was flushed out with argon admitted through a tube at the rear of the lamp.

Microsecond Photographs

Figure 1B shows a picture of the argon flashlamp about 0.5 μsec after the maximum intensity of the flash. It may be observed that the luminosity is slightly more intense, and perhaps near the maximum, around the circumference of the face, that is, in the narrow outer region slightly removed from the immediate frontal effect of the explosive. (The front of the lamp had an inside diameter about 0.5 in. greater than that of the explosive charge.) Also evident in the picture is what appears to be a small hole at the center and front of the charge where a 0.5-cm spacer was located. (This spacer was made of cork rather than gelatin.) No light is evident lateral to the direction of propagation of the detonation at the instant of this photograph.

Figures 1C and 1D are pictures of the lamp taken about 3 and 7 μsec, respectively, after the highly actinic flash from the front. In the approximate exposure time of 1 μsec, the hot explosive gases are not sufficiently actinic to appear luminous; and accordingly, the gas cloud pouring out of the front appears black. As the explosion gas spreads out laterally, it obscures the lateral actinic flash in the

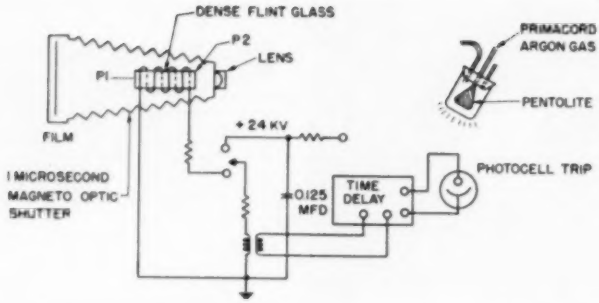

Fig. 3. Rapatronic magnetooptic camera arrangement used to photograph the argon flashlamp.

argon, that is, at the rear portion of the lamp and around the apex of the conical charge.

Figure 2 is a scaled reproduction of the oscillograms obtained on explosive flashlamps having frontal argon atmospheres 0.5, 1 and 2 cm thick. No corrections have been made for adjustment to reference oscillograms obtained with a standard 10 million cp lamp prior to each experimental shot. With 0.5 cm of argon the major portion of the flash was over in 1 μsec or less. The exact shape of the increasing and decreasing luminosity curve could not be ascertained on the recorded scale. The average of the three records for 0.5 cm of argon, by comparison with records of a standard 10 million cp lamp, reveals a peak intensity of about 225 million cp. The flashlamps with 1 cm of argon had a duration of 2 μsec for the maximum luminosity, and the initial rate of increase in luminosity appeared to be approximately that for the 0.5-cm argon layer, but there was a slightly higher maximum. The maximum intensity was 250 million cp. With 2 cm of argon the first and major portion of the luminosity increase was practically as rapid as for the two preceding spacings; however, the duration of the maximum luminosity was about 4 μsec, and the peak intensity was about 300 million cp. The uncertainty of the reference standard for this record makes the maximum a little more uncertain than for the others. A small, trailing luminosity was evident about 1 or 2 μsec after the main flash in all cases. This phenomenon could be attributed to a lagging luminosity at the circumference, as indicated in Fig. 1B.

Discussion of Results

The oscillograms indicate that the duration of the main flash from the argon flashlamp, as measured by the writers, is about 2 μsec for each centimeter of thickness of the argon layer. The maximum intensity is developed after one-half to three-quarters of this time interval has elapsed. The measurements cover argon layers 0.5 to 2 cm thick. The time for development of the maximum intensity probably is related to the time required for the shock wave in the argon to reach the front of the lamp.

The average peak intrinsic brilliancy of the sheet of light-radiating argon gas is calculated by dividing the peak light (225 million cp) by the area (33 sq cm). This value is 6.8 million cp/square centimeter. Flash bombs with larger output would supposedly be of larger argon area. Some care might be required to initiate the flash of all portions of the sheet of gas at the same instant.

The duration and light-intensity data of Muraour et al.[2,3] closely resemble

those presented here, but these investigators did not determine the time-intensity curve. They calculated the average intensity from the measured photoactinic effect on film (by comparison with a standard) and from knowledge of the duration determined either by photographing rapidly moving objects of known velocity, or by use of rotating-drum-camera pictures.

Continuing experimental studies of explosive flashlamps should consider other rare gases such as krypton, neon and xenon as well as other explosives for creating the shock wave. Since xenon is preferred to argon in electronic flashlamps, it is assumed that it might be better in explosive lamps.

Photography With Argon Flashlamp

Consider now the photographic use of the 1-μsec argon flashbulb as described. The following relationship is often useful in arriving at a preliminary set of exposure conditions:

$$DA = \sqrt{KQM}$$

where

D = lamp-to-subject distance in feet
A = aperture of lens
Q = total light output in lumen-seconds
M = reflector factor
K = a constant which depends upon the type of film used and the processing.

For the argon flashlamp without a reflector, $M = 1$ and $Q = 10 \times$ cp-sec $= 2000$ lm-sec (approximately). K is about 0.25 for fast film. Now if A is selected to be about $f/4.5$, then the lamp-to-subject distance, D, can be calculated. D equals about 5 ft.

This result must be used with judgment, depending upon the reflectivity of the subject that is being photographed. Often a sheet of white cardboard immediately back of the subject is very useful in giving a silhouette of darker portions of the subject.

The contrast of photographs is usually low when they are taken with blue light of short exposure time. This lack of contrast can be corrected by a longer development time or the use of a more vigorous developer.

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Integrating-Type Color Densitometer

By FRANK P. HERRNFELD

This color densitometer is for making diffuse density measurements in the blue, green and red, as well as visual bands. This densitometer utilizes an integrating bar for gathering the light, therewith greatly increasing the sensitivity as compared to other methods presently used.

THE REQUIREMENTS for a color densitometer are very similar to those of a black-and-white unit. Enumerated according to importance, they are:

1. reproducibility of readings,
2. simplicity of operation,
3. sufficient range and flexibility,
4. accuracy, and
5. electrical calibration.

Reproducibility of reading was actually the hardest part of our design problem. We found that a stable amplifier alone was not the answer. It calls for rugged mechanical construction, the selection of the proper photoelectric cell, stable optical filters, a color-corrected optical system, and many small features too numerous to mention. When the desired stability was reached, the unit was finished.

Presented on April 24, 1952, at the Society's Convention at Chicago, Ill., by Frank P. Herrnfeld, Frank Herrnfeld Engineering Corp., 5880 Blackwelder St., Culver City, Calif.

Figure 1 shows the optical schematic of the instrument. As light source we use a General Electric 4AT8-34 lamp rated at 8.5 v 4.0 amp. In operation the lamp burns at 7.5 v, has an approximate color temperature of 3000 K, and a life expectancy of 500 hr. In standby condition, the voltage is reduced to 5.0 v. A special socket insures proper electrical contact and placement on the optical axis. Both vertical and horizontal adjustments of the lamp socket are provided.

The condenser lens has full achromatic correction and focuses the filament of the lamp onto an aperture. An interrupter wheel and an infrared absorbing filter are located between the condenser lens and the aperture. The interrupter wheel, driven by a 3600-rpm synchronous motor, modulates the light beam at the rate of 360 cycles/sec, making the use of a stable a-c amplifier possible.

The infrared filter is a Corning No. 9780 2¼-mm thick glass and is always in the light beam. It has the dual purpose of (a) reducing the heat rays reaching

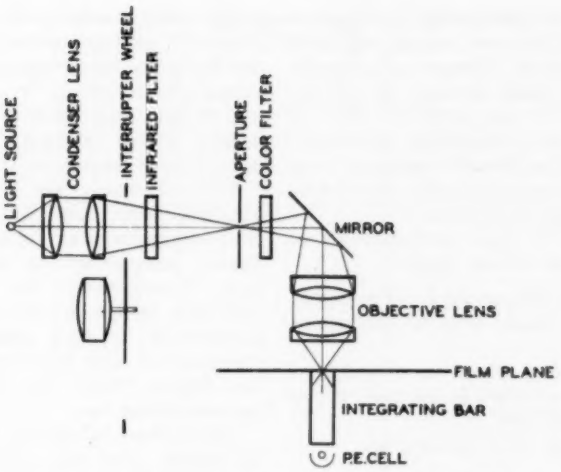

Fig. 1. Optical schematic of the integrating-type color densitometer.

the photosensitive surface of the photoelectric cell in the red and visual setting of the densitometer and (b) eliminating undesirable near-infrared light reaching the photoelectric cell passed by all blue and green filters.

Either of two apertures can be used for making density measurements. One is a round one, illuminating a circle of about $\frac{3}{64}$ in. in diameter at the film plane; the other is rectangular, illuminating a 0.015 by 0.125 in. area. The round aperture is meant for general work and the rectangular one for the measurement of variable-area sound track.

A fully achromatic corrected objective lens focuses the aperture onto the film to be measured. The color and visual filters and a front-surfaced mirror are located between the aperture and the objective lens.

Four filters are mounted in a wheel. A neutral density is mounted with each filter to bring the photoelectric cell output to the same value. This minimizes zero adjustment when going from one color band to another. An integrating bar collects the light passing through the film and delivers it to the photoelectric cell.

In checking all available commercial photoelectric cells, we found only two that lend themselves readily to the measurement of density, namely the RCA 1P42 and 929, or the equivalent in other makes.

We found that the 1P42 had an undesirable lag and color fatigue in the blue and green bands with the amount of light necessary to measure to a color density of 4.0. This can be partially overcome by raising the anode voltage above the ionization potential (18 v).

Raising the anode voltage sufficiently to overcome the fatigue problem raises two others: (1) If any trace of gas is left in the photoelectric cell, the cell will become nonlinear in the low density range when the greatest amount of light is present. (2) It will raise the dark current which means more noise, reducing the small margin between signal to noise in the high density range.

The 929 photoelectric cell has a greater output for a given light input, and does not seem to suffer from the above-mentioned shortcomings of the

1P42, but the photosensitive surface is too far from the film to make the tube a good receiver. Means to gather all the light coming through the sample tested have to be provided. This is important when measuring the density of negatives, as all silver images and cyan dyes show a greater density when measured in a spectral system.

We know of only three methods to measure true diffuse density:

1. placing the sample to be measured directly in contact with the photosensitive circuit,
2. utilizing a sphere, up to now considered the standard in the motion picture industry, and
3. utilizing an integrating bar.

The first method, theoretically the most simple, is nearly impossible in actual practice. The second method, excellent in black-and-white measurements, introduces too much loss into the system. Depending upon the method of coating and the size of the sphere, a loss of light equivalent to inserting a density between 1.3 and 1.5 is the minimum obtainable in practice. Adding this loss to the insertion loss of the optical filters will restrict any instrument using a design similar to ours to a maximum density range of 3.0.

The third method, the integrating bar with a diffusing surface toward the film to be measured, retains all the advantages of a sphere. It introduces a loss of light equivalent to inserting a density of 0.6, making diffuse color density measurements of 4.0 possible.

Table I shows the measurements obtained from three common sound track emulsions when measured with a sphere, integrating bar and spectral type of instrument. For comparison they were measured with a sphere-type densitometer having a visual-type color characteristic and the visual filter on our Model 1503A with and without the integrating bar.

The differences between readings of the sphere type and 1503A with the integrating bar are due to difference in spectral sensitivity of the two instruments.

Figure 2 shows the spectral distribution of the light source and the visual filter with this light source compared to an average eye characteristic.

Figure 3 shows the spectral distribution of the three combination color filters with the light source shown in Fig. 2.

As mentioned before, the Corning No. 9780 infrared absorbing filter is

Table I. Comparison Test of Three Common Sound-Track Emulsions
(using Pathé 2B Sensitometer).

	E.K. 5373, 4-min dev.			DuPont 836, 5-min dev.			DuPont 831, 9-min dev.		
Step	RA-1100B	1503A	1503A-S	RA-1100B	1503A	1503A-S	RA-1100B	1503A	1503A-S
1	0.04	0.03	0.05	0.05	0.05	0.07	0.09	0.09	0.13
3	0.06	0.05	0.08	0.06	0.06	0.09	0.11	0.12	0.15
5	0.11	0.09	0.16	0.12	0.10	0.19	0.18	0.19	0.26
7	0.19	0.17	0.29	0.20	0.17	0.31	0.40	0.44	0.56
9	0.33	0.28	0.48	0.33	0.29	0.50	1.00	1.08	1.37
11	0.49	0.46	0.71	0.53	0.48	0.75	2.05	2.16	2.63
13	0.69	0.66	0.95	0.77	0.71	1.06	3.18	3.28	3.75
15	0.90	0.88	1.21	1.07	1.00	1.43	3.87	3.97	4.+
17	1.12	1.10	1.47	1.39	1.33	1.80			
19	1.31	1.31	1.67	1.71	1.67	2.13			
21	1.45	1.47	1.81	1.94	1.95	2.38			
Gamma	0.69	0.69	0.88	0.96	0.96	1.17	3.66	3.66	4.68
Q	1.27			1.22			1.28		

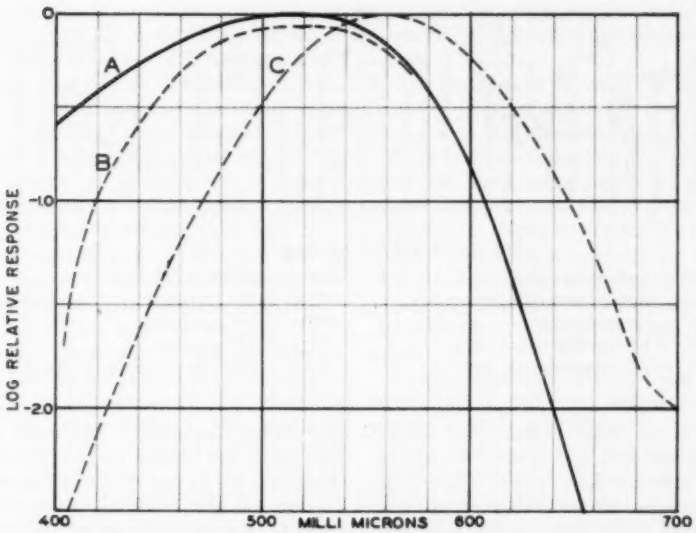

Fig. 2. Response of light source visual filter and eye. A: tungsten 2780 K + Corning 9780 + 929 photoelectric cell; B: light source + Corning 3389; C: average human eye.

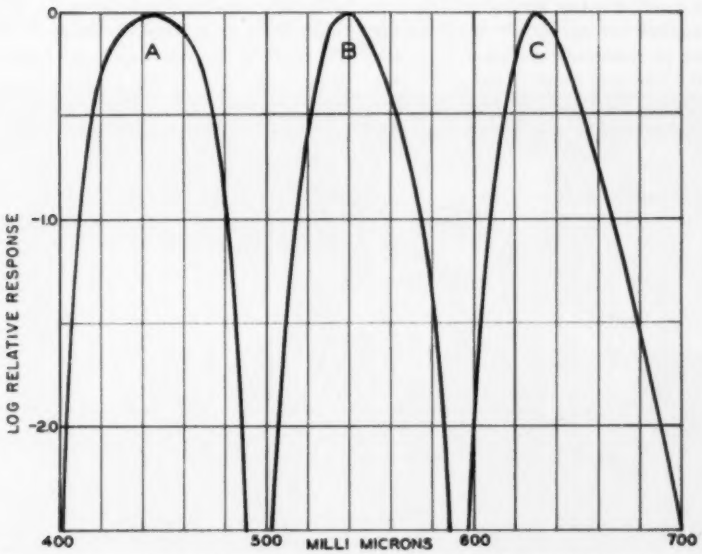

Fig. 3. Response of color filters. A: light source + Corning 3389 + 5113; B: light source + Corning 3486 + 4010; C: light source + Corning 2408.

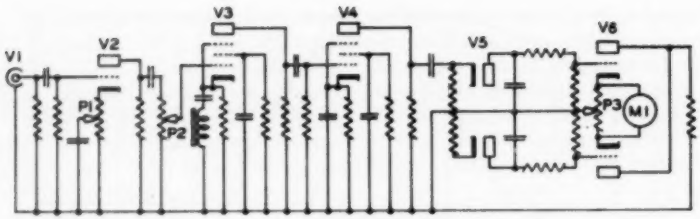

Fig. 4. Amplifier schematic.

M1 — indicating instrument
P1 — zero density adjustment
P2 — range selector
P3 — 1.0 density adjustment
V1 — 929 photoelectric cell
V2 — 12SF5 amplifier
V3 — 12SJ7 amplifier
V4 — 12SJ7 amplifier
V5 — 12H6 rectifier
V6 — 12SL7 vacuum-tube voltmeter

always in the light beam. The visual, blue, green and red filters are located in an indexed color wheel. The blue filter consists of two Corning glasses, Nos. 5113 and 3389; the green filter of two Corning glasses, Nos. 4010 and 3486; and the red of one Corning glass No. 2408.

The minimum bandwidth of the system is fixed by the filters having the least amount of output in conjunction with the photoelectric cell used. In this case, the Corning glasses Nos. 9780 and 2408, with the 929 photoelectric cell and the lamp burning at 3000 K determine the bandwidth. The green and blue filters are chosen to give a similar characteristic having greatest transmission at 540 and 445 mμ respectively. Corning glasses were chosen for their greater permanence.

Figure 4 shows the electrical schematic of the amplifier. The zero adjustment is in the cathode of V2, the first amplifier tube, and has a range of about 8 db, equivalent to a density change of 0.40. P2 is a 20 db per step pad, having a total range of 100 db, giving ranges of 0 to 1, 1 to 2, 2 to 3, and 3 to 4. Also included is the 1.0 calibration position.

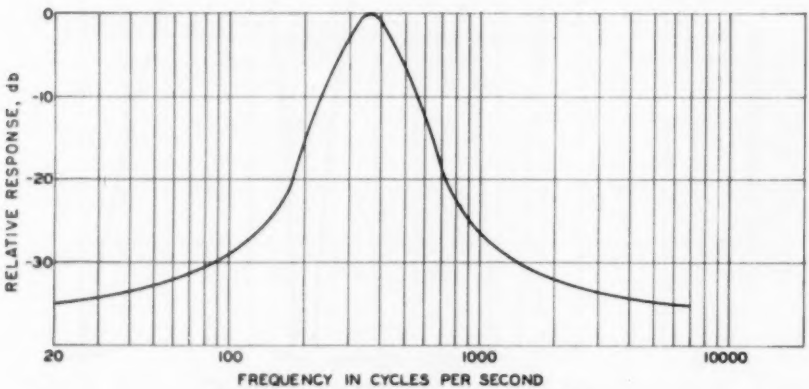

Fig. 5. Frequency response of amplifier.

V3 and V4 are a stabilized amplifier of constant gain. V5 and V6 comprise a balanced vacuum-tube voltmeter. Line voltage changes are balanced out and will not affect the readings. This does not mean that the instrument should be used without a voltage regulating transformer, as changes in the supply for the light source will greatly affect the stability of reading.

The indicating meter M1 has special pole pieces to give the instrument an approximately linear scale with logarithmic input over a 10 to 1 range. The circuit is arranged in such a manner that with an increase in current, the coil of the meter moves into a magnetic field of lesser density. This arrangement prevents a runaway condition and makes for a better instrument. P3 is the 1.0 calibrating adjustment.

Figure 5 shows the frequency response of the amplifier section V3 and V4. This characteristic is caused by the tuned circuit in the cathode circuit of V3. The peak transmission corresponds to the frequency of the interrupter wheel in the light beam and eliminates to a great extent errors in reading due to stray light reaching the photoelectric cell.

The filaments of all tubes are fed from a direct current source. The anode voltages on the photoelectric cell and of V2 are sufficiently low to eliminate any noise and nonlinearity due to gas present in the tubes.

Figure 6 shows the finished instrument. The unit is made to fit into a table or desk with the power unit to be mounted out of the way of the operator. All controls are located on top of the panel.

Upon completion, the unit was tested with several different lamps as light source. Reproducibility of readings was checked over a four-week period. The first two weeks the unit was checked each working day by the hour on the hour, allowing a 5-min warm-up period before making a reading. The instrument was shut off after each test. The latter two weeks the instrument was left on continuously.

The readings thus obtained were in all instances within 0.02 of the original

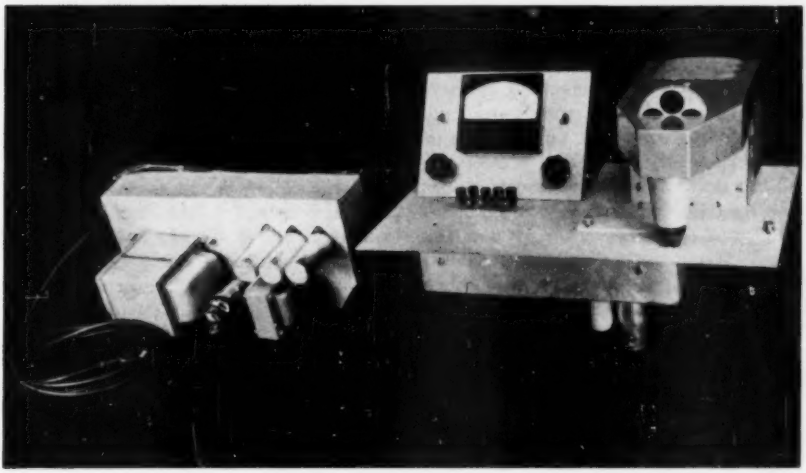

Fig. 6. Model 1503A color densitometer.

measurement. Aging or changing of the lamp had no influence on the readings.

The different density ranges and calibrations are selected by five push buttons plainly marked in front of the meter case. The film strip is held in a step-calibrated carriage, allowing easy selection of different tablet steps. After a 15-min warm-up period, recalibration is seldom necessary.

The maximum range of the instrument is sufficient for all measurements encountered in the motion picture industry. Selection of the proper filter is simple and sure. All readings taken are diffuse readings and no change of location of the photoelectric cell is necessary.

The absolute accuracy of reading, compared to a sphere-type and visual-type instrument, is sufficiently close for all purposes for which the instrument may be used. A 20-db signal-to-noise ratio on its highest reading, at a density of 4.2, guarantees accuracy over the complete range. The bandwidth of each of the three color filters is sufficiently narrow, and the suppression of all unwanted radiation sufficient to give an insertion loss of more than the equivalent of a density of 7.0 to white light when any two of the three filters are placed into the light beam at the same time.

The instrument is calibrated electrically. The accuracy thus obtained is only a function of how much care has been taken in doing it.

Several of these instruments are now in commercial service and have given consistent results.

Transmission Color in Camera Lenses

By PHILIP T. SCHARF

The color contribution of a lens has been defined in terms of its transmittance density at 400 and 700 mμ. It is proposed that the difference in the densities at these two wavelengths be held to 0.05 ± 03 for motion picture camera lenses; 0.05 ±.05 for other camera lenses. To prevent the curve from being too highly inflected between these two points an additional requirement is that the minimum density between 400 and 700 mμ differ from the density at 700 mμ by no more than 0.04 density units. It has been found convenient to describe quantitatively the glass absorption by a term called "color index." A simple method of determining the combined effect of glass absorption and surface coating is outlined.

THERE HAS BEEN considerable interest in recent years in the subject of camera lens transmission. Prior to the advent of antireflecting coatings it was not unheard of to have light losses amounting to as much as 50%. With present-day coated lenses, however, losses greater than 10% are seldom encountered. In terms of lens aperture this means that the loss of light with a coated lens does not exceed $\frac{1}{6}$ of a stop. While there may still be reason for occasionally investigating the overall light loss of a coated lens, other variables in the photographic process will generally mask this $\frac{1}{6}$ of a stop. On the other hand, the color of the light transmitted by camera lenses has caused much less interest, but in present-day practices it is probably more important than the overall white light transmittance. The increased interest in color photography is responsible for the importance of this color factor. Interchangeable lenses on cine cameras have made it possible for the photographer to perform a very critical test for the uniformity of color in his lenses. In this case the same scene, the same film, and the same processing variables are maintained while only the lens is varied. This means that if the same exposure is used, the only variable is the color of the lens. We wish to center our attention on this subject of color variations occurring in lenses, and to investigate methods of minimizing this variation.

There are two distinct factors contributing to the color of a lens. The first is the color of the glass itself. This

A contribution submitted June 17, 1952, by Philip T. Scharf, Process Development Dept., Hawk-Eye Works, Eastman Kodak Co., Rochester, N.Y.

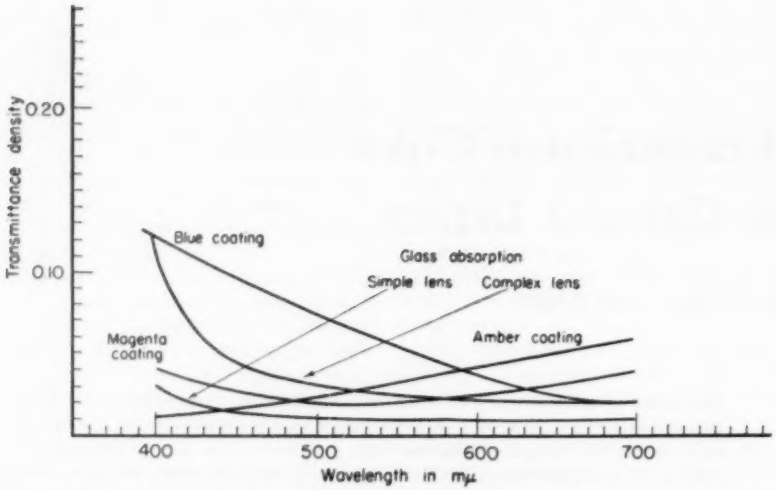

Fig. 1. Transmittance losses from glass absorption and coated surface reflection.

color, generally yellowish, is caused by the ultraviolet absorption band of glass. Modern experiments have proven that in most optical glasses the visual color is a function of impurities present in the raw materials. At some future date, production quantities of all the common optical glasses may be available free of color. Until then we must learn how to use existing glasses. We have made a fairly extensive study of all the commonly used glasses from many sources. Two important findings that have come from this study are that there is a considerable difference between manufacturers and that the sources supplying color-free glasses appear to be able to maintain their quality. These findings have enabled us to put a certain degree of control over this first source of color in a lens.

It is generally recognized that the antireflecting coatings impart a degree of color to the transmitted light. If we observe the light reflected from different thicknesses of these coating films we see that the thinner films are yellowish or amber, the thicker ones bluish, with magenta films lying in between. The yellow reflection means that less blue light is reflected than red or green which in turn can be interpreted as meaning that more blue light is transmitted. Likewise the magenta coating means more green light is transmitted and the blue coating means more yellow light is transmitted. Since coatings do transmit light selectively we have here the second contributing source of color in the lens. An advantage can obviously be gained if we can get these two factors to cancel one another. Figure 1 is a plot of the two color-contributing factors in terms of wavelength and transmittance density. It can be seen that the curve shapes are essentially different so that complete cancellation cannot be hoped for, but a good approximation is possible. Simple lenses having little glass absorption will need less color compensation from the coatings than the more complex lenses.

The complete color specification for a lens is given by its spectrophotometric curve as shown in Fig. 2. However, a single quantity would be convenient to use in expressing the varying degrees of

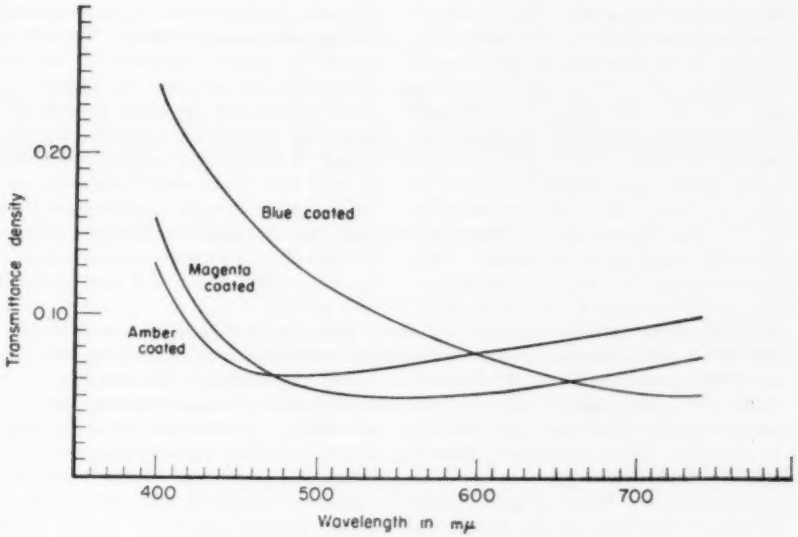

Fig. 2. Spectral transmittance of coated lenses.

color. It was decided that since we are dealing with more or less similar curves the difference in characteristics at two points of the spectrum would suffice to specify the color. From the standpoint of measurement accuracy, wavelengths should be chosen to give as large a density difference as possible. On the other hand the limits of sensitivity of color films are a consideration. As a compromise 400 and 700 mμ were chosen. Since transmittance densities are additive we shall speak of the color contribution in terms of the transmittance density difference at 400 and 700 mμ. That is, $D_{400} - D_{700}$ equals the color contribution.

Having defined this quantity it will be convenient to evaluate the two sources of color in terms of this quantity. To this end we have defined a term known as "color index" for a description of the color of a piece of glass.

If t is the glass thickness in millimeters,

$$\text{Color Index} = \frac{D_{400} - D_{700}}{t}.$$

The glasses most free of color have values from 0 to 0.0005. The worst glasses for color have indices of 0.0300. When using color index as a manufacturing tolerance it has been convenient to multiply by a factor of 10^4 to give integral values 0–300.

To compute the glass contribution we have merely to multiply the lens thicknesses in millimeters by the color index of the glass from which the lenses were made. The use of densities instead of per cent transmittance permits adding the values from each lens element. This gives us a simple method of determining quantitatively the effect of the glass absorption, and now we turn to the coating problem.

The color arising from the film coating is a function of three variables — the index of the glass, the number of coated surfaces, and the thickness of the coated film. The first two are fixed in the design of a lens so that we have only the last variable left for control. The trans-

mittance through a single coated surface may be plotted in terms of transmittance density versus wavelength for varying film thicknesses. From these curves we can tabulate our density difference $D_{400} - D_{700}$ for each of several film thicknesses. If we do this for glass indices from 1.50 to 1.90, we find that for a given film thickness the color contribution $D_{400} - D_{700}$ plotted against glass index gives very nearly a linear relation. This provides us with an important simplification, for, if we have a lens consisting of glasses of differing indices, rather than compute the effect for each index we can use a "weighted index" for the lens as a whole. This "weighted index" is determined by using for each lens element its refractive index times zero, one or two, depending upon the number of its coated surfaces. These weighted values are added together for the entire lens and divided by the sum of the weightings, that is, the total number of coated surfaces. We now use a table having as entries the film thickness and the weighted index. The body of the table consists of the color contributions from the coated glass surface. We have found it convenient to have a table for four, six and eight coated surfaces. The dispersion of glass has been taken into account in setting up the tables, although this is a secondary effect.

The color contribution arising from glass absorption is always a positive quantity, i.e., the $D_{400} - D_{700}$ is always greater than zero since the glass transmittance density in the blue region is greater than in the red. The contribution from the coating, however, takes on negative values as well as positive values and this is what enables us to control the transmission color of the lens. A coating having its minimum reflection at about 500 mμ has a zero value for the term $D_{400} - D_{700}$ regardless of glass index. Thinner coatings have negative values, thicker ones positive values. There is of course a limited amount of control offered by the coating; the higher the glass indices and the more coated surfaces, the greater the control. For example: a lens having a weighted index of 1.70 and eight coated surfaces can have a negative color contribution of as much as 0.11 while the maximum negative contribution from a lens having four coated surfaces and a weighted index of 1.55 is 0.03.

It is now a simple matter to determine the combined effect of glass and coating on the transmission color of a lens. But we are still without a limiting value for this color. It was felt for the most critical lenses, interchangeable cine lenses, the departure from neutrality should not exceed the amount introduced by the lightest filter that may be used. In the Kodak Wratten series of Light Balancing Filters the lightest is the No. 81. It has a value for $D_{400} - D_{700}$ of 0.08. It was found that for the simplest cine lenses 0.02 represented the minimum color contribution. This range 0.02 to 0.08 was therefore taken as a reasonable range of color contribution values for cine lenses. Other camera lenses being less critical for color could have the range 0.0 to 0.10. To avoid any possibility of the spectral curves becoming too highly inflected between 400 and 700 mμ, it is suggested that the expression $D_{700} - D_{\text{minimum}}$ have a maximum value of 0.04, that is, the density at 700 mμ must be within 0.04 of the minimum density wherever it is.

There will of course be camera lenses which cannot be made to meet these color specifications. Large aerial lenses are examples, but in such cases we do not ordinarily have rigid requirements for neutral transmission.

Cameo Film Production Technique

By CHARLES F. HOBAN and JAMES A. MOSES

Educational and psychological principles applied by the Signal Corps in experimental film designed to increase training effectiveness and to cut time and cost of production are presented. Also described are story treatment, studio techniques, and preproduction analysis and planning that are involved in these productions. Results are reported of the evaluation study of film effectiveness and audience reaction to scenario treatment.

NONTHEATRICAL film producers are under increasing pressure to do two things which appear contradictory and irreconcilable. There is the demand that training, information and public-relations films be produced more rapidly and more economically. At the same time, there is a demand that the effectiveness of films be increased. Under conventional production procedures, films cost too much and take too long to produce. When produced, films frequently do not accomplish their purpose as effectively as sponsors hope and have a right to expect. To film producers who equate "film quality" with film effectiveness, it seems impossible to make better films and, at the same time, reduce the time and cost of production.

In this paper we will describe some applications of educational and psychological principles of film influence to story treatment and studio methods being developed by the Signal Corps to improve training effectiveness and reduce time and cost of production. Use of these procedures will be illustrated in the experimentally produced Army training film, TF 11-1752 *How to Operate the Army 16mm Sound Projector Set*. There is some reason to believe that the basic educational *principles* applied to the film on operation of the projector set are not necessarily limited in application to this particular film or to training films of the "nuts and bolts" type. However, we are not concerned with a specific technique used in the experiment. It just happened that the particular production technique fitted the subject and accomplished the desired results. Under no circumstances should the production technique used in this film be construed as a "blueprint" for film productions in general.

Two sources of inspiration for improved film production procedures and techniques are currently available. *For one thing*, the possibility of low-cost, rapid program production has been explored extensively by commercial television and

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by the Navy's Special Devices Center at Port Washington, N.Y. The affinity of television to radio, by way of establishment of television studios and networks in association with radio studios and networks, brought into television a group of artists, craftsmen and technicians not too familiar with motion picture production and motion picture studio practice. Partly because of studio and small-screen limitations, and partly because of fresh talent in the television industry, television has changed the format of video presentation and revived many techniques successfully used in the past in military training and other nontheatrical films.

The second influence on film production methods and techniques, particularly in training and informational films, is the growing body of research data on factors which increase the instructional effectiveness of motion pictures. On the whole, this research has tended to verify and emphasize the applicability to motion pictures of well-known instructional procedures, and to demonstrate that the training and informational effectiveness of films is measurably increased when instructional procedures are incorporated into film production.

This emphasis on instructional techniques in training and informational films is almost as unwelcome to the professional film producer as is the emphasis of the television producer on production shortcuts and simplified background and sets. Teachers are, as J. E. Morpurgo says in *The Impact of America on European Culture*, "the depressed class in America's predominantly commercial society." Instruction techniques are associated with teachers. Submergence of teachers in the American value system submerges

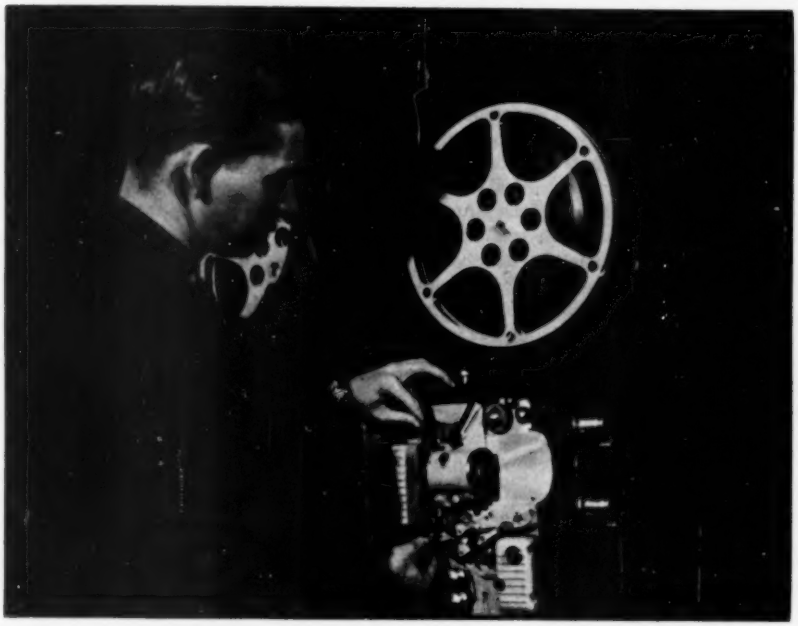

Fig. 1. "... occasionally Jim steps out of his role, and for a moment, is the master of both the machine and of the practical aspects of the theory."

the prestige of instructional techniques identified with teachers. However, the relationship of scientific research in nuclear physics to the engineering development of the atomic bomb had the indirect effect of raising the status of scientific research in the American value system. The soft-spoken professor, with umbrella and academic detachment, achieved sudden and unprecedented status. Consequently, academic research on motion picture influences and on factors which increase effectiveness of motion pictures in training and information has today achieved a prestige and a measure of governmental support completely unknown before World War II.

The net effect of instructional film research has been the renewed emphasis in nontheatrical film production on application of these techniques. Where teachers failed to influence producers of teaching films the research technician, working under controlled laboratory conditions and employing such terms as "audience participation" to describe what was formerly referred to as "reciting" and "classroom drill," has succeeded in raising by halo effect the status of instructional techniques as a recognized element of training and informational films.

Our discussion of the relationship of these two factors, i.e., (1) instructional film research findings and (2) television emphasis on rapid, low-cost programming, to current trends and innovations in training and informational film production will be organized around three topics: first, *story treatment;* second, *studio methods;* and third, *preproduction analysis and planning.*

I. Story Treatment

There are several things about the story treatment of the Signal Corps' experimental film, TF 11-1752 *How to Operate the Army 16mm Sound Projector Set,* that were intended to serve the dual purpose of cutting production time and cost and increasing training effectiveness of the film. First, we incorporated into this film a number of instructional principles which have firm foundation in current theory of educational and social psychology. One such principle, long stressed by William A. Brownell, distinguished educational psychologist, is that instructional materials, to be instructionally effective, must be produced so as to reflect *process of learning*, not simply the *product of learning*.

Following this dictum, story treatment of TF 11-1752 was developed so as to teach operation of the projector in the way trainees actually behave in learning this operation, and not exclusively to demonstrate the way projectionists behave after they have learned and practiced their lessons.

To do this, two characters were created: Jim, the trainee; and the off-stage voice of the expert. This provided two models for the audience: the one who could be imitated immediately, and the other who represented a model of future performance. The technique of the off-stage voice had been used previously by the Signal Corps in production at the end of World War II of a series of films on map reading.

Jim, the trainee, was carefully developed in the scenario and carefully cast. His ability to handle the projector set, clean it and operate it is established on a level slightly above that of the complete novice, but somewhat below that of the expert. Occasionally, in the picture, Jim steps out of his role and for a moment is master both of the machine and of the practical aspects of the theory. But, characteristically, Jim is the pleasantly alert and occasionally forgetful American young man, temporarily in Army uniform, who prides himself on his ability to master machines and complicated equipment.

Jim is objectified on the screen. He can be seen and heard and his performance can be carefully observed and easily

evaluated by the trainee audience. The off-stage voice, on the other hand, is transparent. The audience is free to project physical characteristics, rank, occupation and status into the off-stage voice. His competence as an expert, however, is thoroughly established in the film — that, and no more. Preliminary analysis of audience reaction to this film, under actual classroom conditions, indicates that the off-stage voice is dominant in the film, and that the audience projects more desirable qualities into this unseen character than to Jim, who appears in almost every scene.

In developing the story treatment into which the characters of the trainee and the experts are interwoven, two additional principles of instruction were introduced. To be effective as a teaching device, it was essential that the film have a *psychological organization* rather than a purely logical organization. Experience in projectionist training indicates an impatience on the part of the trainee with postponement of practice in the actual threading and operating of the projector, and lack of readiness for instruction in assembly, inspection, preventive maintenance, nomenclature and disassembly, until the point of operation has been passed. Logical organization of the treatment of the subject, based upon identification and explanation of component parts and on time sequence of operations, would, it was assumed, go contrary to the readiness of the audience for instruction. The law of readiness is an old concept in educational psychology, and a valid one. Deliberately to proceed in film instruction contrary to this law would, at least theoretically, reduce the teaching effectiveness of the film. The problem of logical versus psychological organization of subject presentation was solved, in part, by backing into the subject. This was done by opening the film with Jim, the trainee, preparing to place the full reel of film on the feed arm, and to thread and operate the projector.

Another instructional principle introduced into the story treatment was that of *interrupted action*. An audience has a tendency, amounting to a compulsion, to complete an action once the action has been started. Interruption and suspension of action before completion, or omission of a part of a film obviously included in the original version, tends to create a tension in the audience which can be satisfactorily discharged by completion of the initiated action or exhibition of the omitted part. This tendency is well documented, and is closely related to the well-known psychological phenomenon of closure. The problem in film production is to apply the principle of interrupted action to story treatment so that it operates to increase the involvement of the audience in the subject of the film and thereby increase learning and retention.

The off-stage voice was used to accomplish this intent. Actually, the off-stage voice served several purposes. As already indicated, it constituted a transparent model of expert knowledge and competence in operation of the projector set. Second, the off-stage voice, by remaining off-stage, permitted individual visual concentration on Jim, the trainee, and on the projector set. Third, the off-stage voice was used as a device, a gimmick, if you will, for repetition and emphasis of the important teaching points of the film. Finally, the off-stage voice was used as a device for interrupting Jim's progress in threading and operating the projector in order to insure and insist on prethreading and preoperating checks, cleaning and projector adjustment. Preliminary analysis of field evaluations of this film, to which reference has already been made, indicates that, while the interruptions may have annoyed the audience, the teaching effectiveness of the sequences accompanying the interruptions appears to have been strengthened.

Two other characters were used —

one, another off-stage voice somewhere in the gallery; the other, a clearly visual WAC. The Voice-from-the-Gallery had a twofold purpose. The less important of these was that of a gimmick used to sustain interest in the film by the introduction of contrast and disharmony.

Generally speaking, nontheatrical film producers act on the premise that it is impossible to maintain audience interest for thirty-odd minutes in a film dealing with the operation and care of a piece of technical equipment such as the JAN projector set. This premise sometimes approximates an article of credo in the trade. Use of the Voice-from-the-Gallery was a nod to this credo and a form of insurance against possible waning interest in the audience. The more important reason for use of the Voice-from-the-Gallery was to simulate audience participation in the demonstration and explanation of the projector set. The Voice-from-the-Gallery raised the kinds of questions which, it was anticipated, would exist in the mind of the audience. In this way, the Voice-from-the-Gallery acted as audience protagonist during the film showing. It was conceived as somewhat of a character and no attempt was made to disguise this conception in the film. Approximately 10% of the projectionist trainees resent this character, but it is generally admitted that he raised questions pertinent to the subject of the film.

The Voice-from-the-Gallery was also used as a device for emphasizing two facts which needed to be established for the audience: (1) the existence, importance and usefulness of mimeographed directions on operation of the projector; and (2) the concept of the film as a specific training aid, rather than a com-

Fig. 2. "...the off-stage voice was used as a device for interrupting Jim's progress and for repetition and emphasis of the important teaching points of the film.

plete course of instruction on operation of the JAN projector set.

In shooting the picture, the Voice-from-the-Gallery was recorded during the noon-hour lull of one day of production. The off-stage voice, however, was recorded in dialogue on the set simultaneous with the live action. This procedure was intended to increase the spontaneity and realism of the running dialogue between Jim and his off-stage mentor.

The fourth character in the film was the WAC. The purpose of the WAC sequence was to poke fun at the complaints about the weight of the complete projector set. The facts are that the JAN projection equipment is heavy and consists of three pieces. There is no point in pretending in the film that these facts do not exist. The alternative is to attempt to reduce possible adverse reaction to these factors. Contrary to some expressed audience reaction, the WAC is not a lady wrestler. Her facility in carrying the projector and amplifier was actually a facility in carrying an empty projector and amplifier case supplied by the prop department.

The WAC sequence is pure corn. There is no objection to corn in an instructional film if it is useful as a means of accomplishing one of the purposes for which the film is made. The valid objection to the use of corn in a training or informational film is the use of corn for its own sake. In general, the audience of projectionist trainees sees the WAC as a device for combating gripes or simply as a device to leave the audience in a good mood.

Several other instructional techniques, the importance of which has been indicated in film research, were incorporated into the film. The use of *repetition* has previously been indicated. The threading of the projector was shown three times. The use of the lens lever was repeatedly demonstrated. Care in removal of the aperture and pressure plates was repeated. *Slow rate of development* was a must in acting, shooting and editing. The instruction in the film moves at a rate geared to a learning audience. Except in a few instances, *subjective camera angle* was employed, and *extreme close-ups* were extensively used. Repetition, slow rate of development and subjective camera angle have been shown in experimental film research to measurably improve instructional effectiveness of films demonstrating manual operations.

Basic to story treatment and scenario of this film was the concept of *conflict* and the importance of conflict in the learning process. If there are no obstacles to be overcome, or no need to overcome obstacles, there is little or no need to learn. Hence the introduction of the concept of conflict into the story treatment. Throughout the film, there is the continuing problem of whether Jim will triumph over the machine or the machine over Jim. In counterpoint, is the implicit and friendly conflict between Jim and the off-stage voice. These sorts of conflict prevail and are accepted as challenges in the American culture.

The general principle of story treatment of instructional films underlying the Signal Corps' use of the conflict concept in the experimental film is the desirability, if not actual necessity, of taking into account those *characteristics of the culture* of a society which are dominant in social behavior, and to incorporate these cultural characteristics into films in order to increase the audience acceptance of the informational and instructional content of the film. Perhaps more than we realize, these cultural characteristics may be extremely important to the dynamics of film influence and film realism than elaborate backgrounds, establishing sequences and the polished perfection of studio props.

Throughout the story treatment and scenario preparation of TF 11-1752 was the psychologically respectable but frequently ignored idea that, since instruction has to do with learning, and learning

is done by the learner, *the subject must be approached from the point of view of the learner.* Training, informational and propaganda films are often produced from exactly the opposite point of view. They consist of the expert presentation of a subject by an expert on the subject on the assumption that film is some sort of magic medium of transmission of wisdom from the wise to the ignorant.

II. Studio Techniques

The term Cameo Technique is used here to describe some of the studio techniques applied to the experimental film, TF 11-1752, in order (1) to cut time and cost of production and (2) to increase teaching effectiveness of the film. As we all know, a cameo is a stone on which a character is carved in relief. The TV Cameo Theater is so named, presumably, because of the exclusive employment of the cameo technique in video presentation.

This technique consists of the omission of background in the studio set, the inclusion of only essential foreground objects and characters, and the spot lighting of these objects and character action. Picturewise, these are suspended in an enveloping blackness. Nothing is visible to distract attention from the essential characters and objects around which the story treatment is built. Use of this technique served the twin purpose of simplifying studio production and of increasing audience concentration on the essentials of the subject.

In the production of the Army's film *How to Operate the Army's 16mm Sound Projector Set*, only one set was used, the

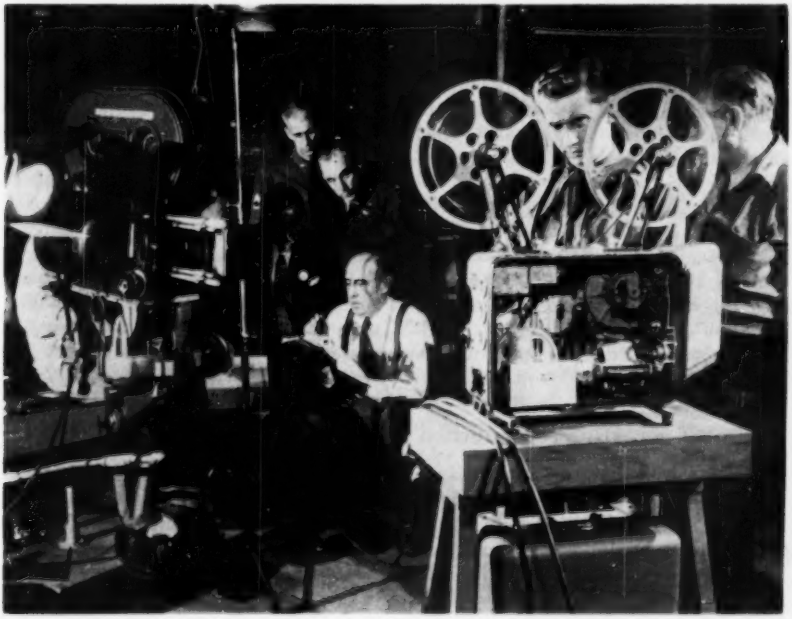

Fig. 3. "In the production of the film on *How to Operate the Army's 16mm Sound Projector* only one set was used."

walls of which were draped with gray curtains, hanging in folds and following the L-shaped pattern of the set. With this L-shaped set, draped in such a manner, only the screen, the speaker, the projector and amplifier, the table for the spare parts, and the actor required lighting, and these by spots. The lack of background permitted easy movement of prop equipments for front, back and side views; long shots, close-ups, reversal shots, and relative constancy of camera position and spot-light location and regulation. The draped L-set (1) facilitated the rapid shooting of the picture and (2) reduced the cost of set construction and lowered personnel requirements for electricians and grips.

The general principle illustrated by the Cameo Technique as used in the Army's TF 11-1752, is that *foreground, not background, is the focus of action and attention in a motion picture.* The context essential to perception of meaning is shifted from more or less accidental and purely situational settings, which vary in any given operation, to a simple presentation of crucial cues, consisting of meaningful and irreducible wholes in which elements, parts and fragments are embedded.

Motion pictures have traditionally been based *de facto* on a theory of fidelity of representation. It has been assumed that an audience can perceive the full meaning of a picture only when a full clutter of all visual background is faithfully photographed and reproduced on the screen. Among other things, intellectual activity consists of abstracting essential meanings from the clutter of context and situation. Where the purpose of a film is to facilitate this intellectual process of abstracting and analyzing essential meanings and essential operations out of their contextual clutter, it seems reasonable that the *principle* underlying the Cameo Technique actually facilitates the desired audience response. The usual studio treatment, based on an exaggerated fidelity-of-representation theory, may interfere with or at least not substantially contribute to this end.

Another aspect of studio and story treatment of TF 11-1752 which relates to the ideas back of the Cameo Technique is elimination of the conventional build-up in the film of the introduction to the subject. For the most part, elaborate establishment of situations in order to obtain audience rapport is unnecessary, costly and time consuming for an audience reasonably sophisticated in the subject.

In TF 11-1752, the film opened with the projector set assembled and the projectionist preparing to thread the film through the projector. The film is intended for use in projectionist training programs for military trainees, all of whom have completed basic training and presumably are aware that military training is essential to successful military operations and to personal survival, and that training films are *good* training aids; also, that the effectiveness of any film presentation is greatly enhanced by *good* projection of the film.

III. Preproduction Analysis and Planning

It is apparent that story, scenario and studio treatment of the Army's training film, TF 11-1752, involved both a great deal of preproduction analysis and planning, and a working familiarity with theory and research on the dynamics of motion picture influence. If time and cost of production were to be cut, increased emphasis on preproduction analysis and planning was required. If the effectiveness as a training and informational film was to be increased, then the principles of effective instruction had to be incorporated.

Preproduction analysis was needed in three areas: (1) the audience, (2) the objectives of the film, and (3) the situation of film use. In every motion pic-

ture situation, there are always two, not just one, important parts: the audience and the film. We started with the *audience*.

There were two things which we were required to know about the audience before we could effectively plan the film to instruct, inform or otherwise influence the audience: First, who was the intended audience and what was it like? Second, what did the prospective audience already know about the subject?

The anticipated audiences of TF 11-1752 consisted of military trainees — a cross section of American youth. They are motivated by the typical American drive to "get the job over with." Army service is accepted as something necessary to get the job over with, and Army training is part of the job. Eight out of ten of the draftees in today's Army have received some high school education. Fifty-five percent have graduated from high school. Twenty-two percent have attended college. For the most part, these trainees have *learned to learn*.

Since these military trainees grew up in industrial America and have had considerable formal education in the American school system, we assumed that they were already familiar with the following:

1. Electrical cords, plugs and outlets, such as used in homes, schools, etc., as conductors of electricity.
2. Flow of electricity through circuits, controlled by switches.
3. Sound volume controls such as found in radios, phonographs, televisions, and other audio equipment.
4. Electrical motors, such as found in vacuum cleaners, washing machines, electric fans and mixers, and their functional responsibility in the supply of mechanical power.
5. Incandescent lamps, common items in homes, schools, businesses, etc., as a source of light.
6. Sound amplifying systems, such as used in all radios, televisions, phonographs, etc.

The objective of the film was to instruct the intended audiences, described in the preceding paragraphs, so that they would both feel competent to and be able to perform the following operations on the projector:

1. Preoperation check of electrical connections.
2. Threading of film through the projector.
3. Preoperation check on sound system.
4. Prethread cleaning of film path.
5. Prethread and preprojection focusing.
6. Replacement of projection and exciter lamps, and other operating spares.

In addition, it was important that, insofar as possible, the film influence the attitude of the trainees toward the projector and its care and use. These attitudes were spelled out, as follows:

1. The good projectionist uses common sense.
2. While the projector set appears to be complicated, the mastery of the equipment is not difficult if recommended procedures are observed.
3. Careful checking and cleaning of the equipment should be performed before each use.
4. The equipment is not too heavy for men to carry.
5. There is more to learn about the equipment than is shown in the film.

The film was produced for use in organized Army projectionist courses. In all such courses, ample provision is made for classroom practice on the projector set, under the supervision and guidance of the instructor.

In the instructional procedure, the training film, TF 11-1752, will be shown immediately before the students are permitted to handle the projection equipment. A second showing of the film will be scheduled at the end of the course, just prior to the period for the qualifying examinations. Another Army training film, TF 11-1574 *Technique of Good Pro-*

jection, is already being used in the course and will continue in the schedule, to show the importance of good projection in the classroom and how this is accomplished.

With such advanced knowledge of the situation of use, the instruction and practice to follow the showing of the film, and the availability of a sister film covering projection techniques, it was possible to limit the content of the film to the essentials of prepractice instruction. Furthermore, the fact that the audience was enrolled in a projectionist training course made it possible to eliminate the "establishing sequences" and to open directly on the subject. Assembly and disassembly of the equipments were omitted from the film, since these operations are taught in the practice phase, working directly with the equipment.

Considerable experience gained from associating with projectionists and teaching projectionist training courses, and considerable thinking on the objectives of the film in terms of audience performance and audience attitudes toward the Army projector set, went into the first treatment of the story outline, prior to conferences with the writer regarding scenario preparation. The nature of the audience, the assumptions on existing knowledge of the audience, the objectives of the film in terms of performance and attitudes, and the situation of film use were spelled out in advance of the scenario-planning phase.

We encountered no difficulty, no misunderstandings, no obstruction and no opposition anywhere along the line, once performance specifications were clearly set forth for all to examine.

Auditorium Specifically Designed for Technical Meetings

By D. MAX BEARD and A. M. ERICKSON

The Naval Ordnance Laboratory, White Oak, Md., is not only a research and development center for ordnance material, but it has also become a center for the dissemination of scientific information. Technical meetings and symposia of international fame have been held in the auditorium, specifically designed for such meetings, seating 550, with optimum acoustics. Included are a console for control of 21 microphones, telephone communication with the moderator, and controlled levels to sound recording facilities. The projectionist has direct contact with the speaker, the console, the thyratron-controlled overhead lights, and preset stage lighting. Complete audio-visual aids are available.

THE NAVAL ORDNANCE LABORATORY has the primary objective of the development of new and better ordnance for the United States Navy's Bureau of Ordnance, and is destined to become one of the outstanding research centers of the nation. It must be realized not only that it is essential to equip this research activity with the most modern and complete facilities, but also the laboratory must be equally well equipped with a staff of fully informed scientific personnel.

It was recognized late in World War II, while planning for the new laboratory at White Oak, Md., that every effort should be expended to maintain adequately trained technical personnel to make and keep this laboratory a noteworthy research center — whether at war or in peacetime. As a result of these efforts, this laboratory has, in addition, become an intellectual center for the dissemination of scientific information. It is for this phase of endeavor that its auditorium was planned and is dedicated.

The lot of the scientist speaker is not always an easy one. His subject is usually one that must be closely followed and have a minimum of interruptions. He must have full assurance that he can be heard or that his visual aids are clearly discernible to the entire audience. Of equal importance is the comfort of his audience, who must expend a considerable amount of mental effort to keep up with the subject, and certainly cannot do so if there is an accumulation of distractions such as hard seats, foul

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Fig. 1. The NOL auditorium showing lectern in its normal position, with microphones in place for audience participation. Questions may also be written down and handed to assistants at the aisle mikes.

Fig. 2. Visual aids, such as opaque projection, Viewgraph, charts, blackboard, pointers, etc., are readily available to the speaker even when presenting his talk to a small group from out in front of the stage. Microphones are strategically placed to give the lecturer as much freedom as possible, while at other times lapel microphones are used. Floor outlets would be preferred to the present outlets along the front of the stage.

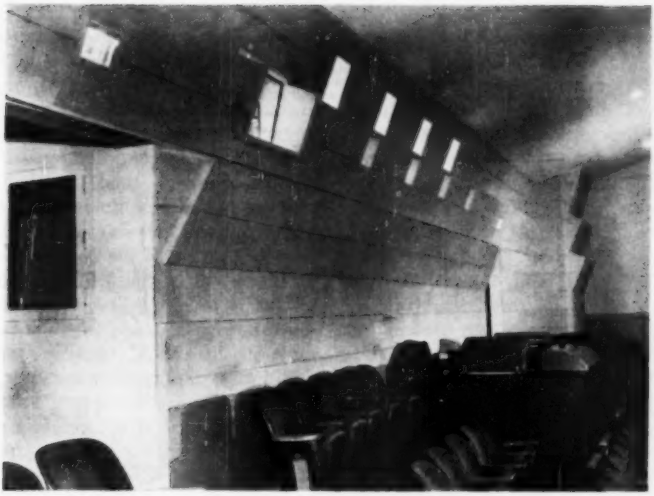

Fig. 3. Rear of the auditorium showing the location of the control console, the contour of the rear wall and the projection-room parts.

air, disturbing lights and poor auditorium acoustics. The NOL auditorium is designed to put both the speaker and his audience at ease.

The major points considered in the design of this auditorium were: (1) audience comfort; (2) intelligibility; (3) availability of visual aids; (4) controlled levels of illumination and sound; and (5) flexibility of the overall system. The facilities for these results are herein described.

Several members of this Society gave excellent advice, and were instrumental in the final design and engineering of the auditorium. Since most contacts were made through the Society, the writers would like to express their appreciation to the Society for this assistance. However, special mention is made of the work of Al Ward and John Volkmann of the Radio Corporation of America who were responsible for the acoustics and sound system engineering, and J. E. Currie of the National Theatre Supply Company who assisted in the layout of the projection sound system on the stage and in the projection booth. The Photographic Division of this laboratory is responsible for the further tailoring of the installation in its present exacting requirements and its operation.

The auditorium, seating 550, has a reverberation time of approximately 0.75 sec, which is slightly less than that of a comparable-size (200,000-cu ft) motion picture theater (see Figs. 1, 2 and 3). To achieve these desirable acoustics, and to keep within the structural limitations of the building, the interior was altered to include polycylindrical sections, sloping floors and a serrated rear wall. Absorbing material was selected and placed to give optimum acoustics, with side walls surfaced with acoustic plaster, the ceiling of standard plaster, and overstuffed theater seats. An on-the-stage lecturer with good speaking quality may be easily heard at the rear of the auditorium without the aid of sound reinforcing. These acoustic properties are not only desirable for lectures, but are ideal for recording purposes.

The stage is similar to small theater installations with several added features such as: (1) a one-ton hoist for moving equipment for demonstrations; (2) alternating- and direct-current power, signaling and microphone outlets available at various points; (3) microphones behind the projection screen, permitting the speaker to have complete freedom from the lectern; (4) removable projection screen and motion picture speaker systems; and (5) sound reinforcing speakers overhead and slightly in front of the stage in the proscenium arch.

The projection booth, shown in Fig. 4, is equipped to handle 16mm and 35mm motion pictures, and 2 in. × 2 in. standard and continental lantern slides.

The standard-size dissolving slide projector was altered to accommodate 1000-w incandescent projection lamps, with special blowers and heat-resistant glass to permit prolonged projection of negative lantern slides. This is quite important since some scientists may discuss one lantern slide for as long as ten minutes. House-light dimmer and curtain controls are located in the booth at each of the viewing ports. The stage light control is centrally located.

Slide-changer buzzer, auditorium monitor, intercommunication and telephone communication are readily accessible to most of the normal operating positions. Accurate focusing of all projectors is accomplished by means of a seven-power monocular sight that is movable to each viewing port. In addition to the monitor speakers on the two sound channels, a sound-level meter is bridged across the stage speaker bus and provides a positive indication of sound level being delivered to the auditorium.

The auditorium sound reinforcing system (Fig. 5) is designed to be controlled from a mixing console (Fig. 6)

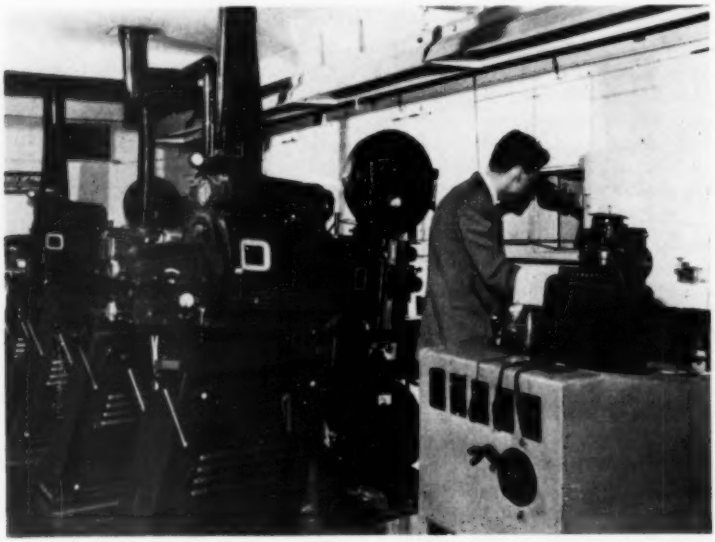

Fig. 4. The projectionist utilizes a monocular sight to get accurate focus on all projection from the booth. The dissolving slide projector controls and modified heat-dissipating system may be noted on the projector at the right of the operator.

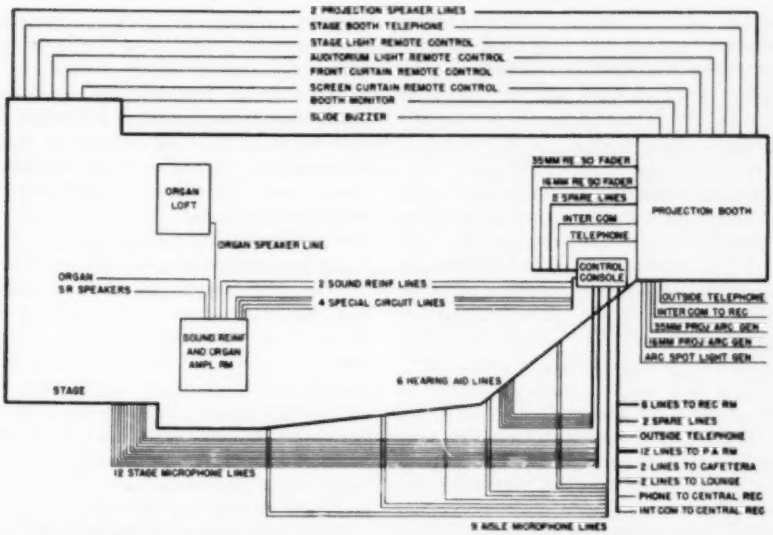

Fig. 5. Schematic of sound and control services. The entire operation for limited services may be controlled from the projection booth, utilizing preset levels at the control console.

Fig. 6. The operator of the control console not only has a clear view of any activity in the auditorium, but has complete control of all sound facilities by means of switches, attenuators for sound reinforcing and recording.

at the rear of the auditorium. This console contains 21 microphone preamplifiers and 2 line amplifiers. As many as 12 circuits can be mixed at one time with provisions of level adjustments on each circuit. One of the two output circuits drives the sound reinforcing amplifiers and the other may be patched to the sound recording facilities, or to other areas on the base at NOL. Communication facilities are available with the symposium moderator, projection booth, backstage and the recording room. The outside telephone is provided with a light signal rather than a bell so that incoming calls do not disturb the lecturers.

This control console mixer system is particularly adapted to audience participation. The operator with his command view of all microphones on stage and in the aisles can switch in microphones or interchange and maintain levels as required. The result is excellent sound reinforcing of all pertinent discussions regardless of whether they are between the lecturer and a participant from the audience, or among two or three members of the audience. This flexibility is extremely valuable where it is desirable to record every word of international symposia.

The auditorium is utilized in many different ways:

(1) For week-long symposia, nearly every facility must be made available to include audience participation, all projection services, lapel microphones, lectern, projectionist working from scripts, intercommunication with outside activities, and complete sound recording, which includes all verbal combats between members of the audience. Performances of this type have not only been completely recorded, but transcribed and eventually published in book form.

(2) Seminars.

(3) Public-speaking training courses.

(4) Junior professional training.

(5) Intra-Defense Department discussions. Many interesting situations come up that can hardly be avoided. Difficulties will probably always arise wherein some lecturers fail to have their slides in order or properly marked, and where they are frequently of such a nature that only the speaker himself can tell which is the top of the slide, or other speakers who in their nervousness continually press the buzzer to the projectionist indicating a change of slides. The projectionist, in his effort to make one change per buzz, may run several slides ahead. Another problem occurs when two audience participants of decidedly unequal voice levels are at microphones on the same console control switch. Conflicts of this type have been eliminated by repatching; however, some problems can hardly be corrected by modification of the facilities.

There are several improvements that are highly desirable in an auditorium designed for this type of operation. Most noticeable among these are the requirements for panels for the use of charts, etc., that may be pushed off stage when no longer required; more complete facilities in front of the stage for small groups; a system of lights on lectern (in view of the speaker only) controlled by the moderator, to warn the speaker he is lecturing beyond his allotted time; an improved system of microphones for audience participation; screen set flush with the rear of the stage; acoustic baffles on the air-conditioning ducts; a stereophonic sound and projection system; acoustic treatment in the booth; and possible use of variable-focal-length lenses for 2 in. × 2 in. slide projection. The magnetic sound track on 16mm film will be a boon to the functions of this auditorium.

The auditorium at NOL, although originally planned about seven years ago, has been kept up to date in most respects and has proven most satisfactory in nearly every respect for the type of performance required of it. Of the five major points considered in the

original planning: audience comfort, intelligibility, availability of visual aids, controlled levels of illumination and sound, and flexibility, the one most overtaxed has been the last. There have never been any regrets that every consideration was given to this in the early planning, and the extra lines, conduits, etc., that were included in the original design have made it unnecessary to make any major or expensive alterations to the auditorium.

Discussion

George Lewin (Signal Corps Photographic Center): I wonder if you've ever given any thought to providing a remote-control of focus on either your slide projectors or your motion picture projectors, so they could be controlled, say, either from the lectern or by somebody in the audience.

Max Beard: We have never tried that. Does it work pretty well?

Mr. Lewin: Well we use it to some extent in running dailies, because there's always a question as to whether the projectionist has the same idea about focus as the audience.

Mr. Beard: I wonder if the speaker close to a screen could determine the focus as accurately as the man from the booth with the telescope;

Mr. Lewin: Well, probably not the person near the screen, but somebody in the audience, that is somebody assigned, of course, by the speaker could take care of that.

Mr. Beard: It's of interest to point out that very often when you're running film, the film goes in and out of focus at times for reasons beyond the control of the projectionist (he's not always watching it that closely).

Chauncey L. Greene (RKO Orpheum Theater, Minneapolis): I've used the seven-power binocular for checking focus as well as trying to control it from near the screen. My personal experience has been that the Navy seven-power binocular critically focused beforehand upon a target located near the screen is far superior to trying to control it from a position near the screen, because you have really a more critical view of what you are trying to do. I've never had much success with a monocular, and a poor quality binocular is worse than useless, but that 7 × 50 Navy glass is probably the world's finest for this purpose. True, if you try to operate the entire projection establishment single-handed, it is not going to receive the attention that it deserves either through binoculars or without them. Lastly, might I express an opinion that this Society could render no greater service than to mail a reprint of this paper to the Visual Education Department of every college or institution of learning in this country.

Mr. Beard: Thank you, Mr. Green. There's an additional comment I might make. The biggest problem we have, when focusing, is the shifting from 3¼ in. × 3¼ in. to a 3¼ in. × 4 in. lantern slides. The projector we have has different positions for these two types of slides, which means that every time you project the continental slide (3¼ in. × 3¼ in.) you have to refocus the projector. This is a big problem with us, since we frequently get a mixture of the continental and standard slides.

Chester Beachell (National Film Board of Canada): Have you any facilities in this auditorium for providing different screens, such as perforated matte, a beaded screen, or a silver screen for a Polaroid stereo projection?

Mr. Beard: We use the perforated screen for all projection. We have not tried the Polaroid system; however, we are quite anxious to do so some day.

Mr. Beachell: It has been my experience that a matte screen won't work on Polaroid stereo at all. It scrambles the light polarity.

Safety Requirements in Projection Rooms and Television Studios

By SAMUEL R. TODD

Nitrate film has imposed special requirements on projection-room design for many years. The advent of 35mm safety film may change some of these, and this possibility is discussed. The increasing use of films, both nitrate and safety types, in television studio operations calls for similar precautions, and the presence of considerable electronic equipment adds to the normal hazards. These hazards and certain others peculiar to live program presentations are discussed. Safety problems involved in the installation and operation of high-voltage television equipment in theaters are outlined.

PROJECTION ROOMS IN MOTION PICTURE THEATERS

Since the first "Nickelodeon" opened its doors to the public for presentation of motion pictures the greatest safety hazard, as is well known, has been the fire and panic danger inherent in the ever-present possibility of accidental ignition of the thousands of feet of cellulose nitrate film located in the projection room. This continuing hazardous condition over the years has been changed recently, to a considerable degree, due to the gradual replacement of nitrate film by the so-called "safety" cellulose acetate film. However, as long as 35mm film remains standard for the projection of motion pictures in theaters, most safety authorities, many theater owners, and those theater designers who are intimately conversant with the numerous details involved in the proper design and construction of modern projection rooms for maximum safety and best operating features, feel that any changes in the specifications now considered as standard are both unwarranted and undesirable. If we assume, and it is a fair supposition, that a fireproof type of construction for theaters will continue to be demanded by local governmental authorities, it seems hardly possible that nonfireproof type of construction for projection rooms would be advocated.

Let us consider, item by item, some of the real reasons for the present type of enclosure for the projection, sound and accessory equipment in the modern theater projection room. To isolate from the auditorium unavoidable noises, such as those due to the operation of equipment and due to conversation necessary from time to time, a sub-

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stantial enclosure is certainly needed. The physical strength alone required to safely support the weight of the necessary equipment, and to allow for the additional weight of four or more persons who may be in the room at one time, calls for the specification of a heavy reinforced concrete floor constructed according to the recommendations of a qualified structural engineer. Also, and for similar reasons, the four walls of the room should be designed to assure structural security and adequate fire protection as well as the necessary physical strength required to support electrical raceways and heavy equipment items which may be mounted on these walls. From long experience in projection-room design, it seems advisable to call for ceilings not less than 9 ft above the projection-room floor level, and of structurally strong and fireproof construction. Costly films, sound and projection systems need protection from theft and from fire hazards elsewhere in the theater as well as vice versa. Solid, fireproof enclosures, with approved fireproof doors equipped with trustworthy locks, are thus well justified whether or not the films used introduce any special fire hazards.

In the event a fire does occur in the projection room, it is instantly and imperatively necessary to completely isolate the room from the auditorium in order to prevent possible audience panic. Panics kill far more people than actual fires do. Projection and observation port openings must be equipped with gravity-operated, automatically controlled, approved steel fire shutters actuated by a master control cord and by 160° fusible links, located immediately above and within 6 in. of the upper magazine of each projection machine. In the event of a projection-room fire, it is necessary to exhaust promptly all smoke and odors to the outside air. This may be accomplished by means of an adequate, forced-draft ventilating system; this system may also serve to exhaust normally the gases and carbon ash from carbon-arc lamp enclosures. A natural gravity vent, with adequate cross-sectional area extending through the projection room ceiling directly to the outside air, should also be provided as protection in case of failure of the electricity supply service.

Consideration should be given to the dimensions of the projection room in order to provide normal operating safety factors for the projectionist. The room should be not less than 12 ft between front and rear walls, in order to have sufficient working and free walking space around all equipment. The rewind table should be located at the rear wall equidistant from the two projectors. The space between projectors should be sixty in. at the lens centers and there should be a clear space from the lens centers of 48 in. both to the right of the righthand projector and to the left of the lefthand projector. A modern design for the rewind table includes space beneath the table top for locating approved-type film containers, supported several inches above the floor. In order to deliver on the screen the high-quality performance expected from the projectionist, he must at all times, while on duty, be reasonably calm and alert both mentally and physically. These considerations, as well as those of common decency, call for providing adequate modern toilet facilities and a lavatory with both hot and cold running water in well-designed theater projection rooms.

This brief review and discussion of present safety requirements in theater projection-room construction is intended to justify the conclusion that practically all of the requirements are in order regardless of the type of film used. They obviously must not be relaxed in any degree so long as there is a possibility that even small quantities of cellulose nitrate film may reach the theater, and this possibility may be with us for years to come. Entirely

apart from this, however, it has been shown that they lead to improved program presentation and better general safety conditions for both the public and the theater personnel. This is important; twenty years of good engineering design and proven operational practices have created public confidence in theater safety. This could be destroyed by a single instance where loss of life was rightfully or wrongfully attributed to a relaxation in the presently accepted standards. Furthermore, it should be kept constantly in mind that there is no moral defense for anyone who may be responsible for deliberate laxity in the construction and operation of theater projection rooms if a fire does occur and the sordid picture of a disastrous panic is the tragic result.

TELEVISION INSTALLATIONS

Projection Rooms

The equipment necessary in television station projection rooms creates possible hazards of the same type inherent in the projection rooms of motion picture theaters. With the present use of 35mm film and projectors equipped with the Synchro-Lite, instead of the conventional carbon-arc lamps, hazards affecting the safety of the operating personnel are definitely and continuously present. For example, this gas-discharge gap lamp employs potentials up to 5000 v across its terminals. The standard motion picture projection equipment, as observed in television station projection rooms, consists of two 16mm projectors and two 35mm projectors, each equipped with the Synchro-Lite as the light source. As long as 35mm film continues to be used for programming purposes, the hazard inherent in the possible use of nitrate base film will require the acceptance of safety regulations as heretofore found necessary in the projection rooms of motion picture theaters.

The panic that may be created by the sudden and violent combustion due to the ignition of perhaps a thousand or more feet of nitrate film, or the uncomfortable situation incident to one of the operating personnel lying prone from the effects of an electric shock, are possible situations requiring very special consideration from those individuals charged with the responsibility for formulating safety rules and regulations for television station projection rooms. The safety requirements for projection rooms in television stations should include as a minimum: (a) standard fireproof construction of the projection room; (b) the proper floor dimensions to provide good operating conditions; (c) approved storage facilities for the film; (d) an approved rewinding device for 35mm film; (e) the installation of approved, self-closing, automatically controlled fire shutters for the port holes; (f) the proper projection-room ventilation, including both gravity and forced-draft methods; and (g) the provision of adequate means for instant exit for the operating personnel through openings equipped with fireproof self-closing doors opening outward. As in the case of theater projection rooms, nearly all of these requirements are fully justified on a simple common-sense basis without any consideration of the special hazards introduced by the possible use of cellulose nitrate film. A typical television projection room incorporating the design features which have been mentioned would be self-contained, having the moving picture machines project the light through a wall directly into the camera chain located in the adjoining room. Figure 1 shows in detail some of the safety features incorporated in a typical well-designed television studio projection room.

Studios

With the increasing use of a great variety of household appliances in the production of television programs, haz-

Fig. 1. A typical well-designed television studio projection room showing in some detail some of the safety features.

ards are being introduced which require continuing alertness on the part of the producing and operating personnel. For example, in the demonstration of open-jet gas ranges the possibility of conflagration in the studio is always present. Perhaps to a lesser degree this also applies to the use and demonstration of electric ranges and other electrical appliances with exposed heating elements.

In the larger studios, with arrangements for seating studio audiences of 50 to 100 persons, the producing and operating personnel must ever be alert to unforeseen accidents that may cause a panic. Figure 2 shows a typical, large studio with the possibility of having large numbers of people confined within its walls and hence subject to all the usual and unusual panic hazards. In addition to the possible hazards just mentioned, special attention should be given to the safe installation of heavy lighting equipment, whether such equipment is directly suspended from the

ceiling or mounted on balconies, and to adequate supports for heavy lighting units at the floor level. These precautions should also apply to special rigging apparatus used to support and shift special scenic effects, and to all stage properties. In these larger studios, where relatively large groups of people are admitted, adequate exits with approved illuminated directional signs should be provided. Figure 3 shows the extent of the special lighting equipment and other production apparatus which may be encountered in a typical modern studio.

Theater Television Using Direct Projection

The installation of theater television equipment has introduced problems not heretofore present in providing motion picture screen presentations. Essentially, the equipment purchased by the theater owner for such an installation consists of three major items: (a) a high-voltage supply unit weighing 800 lb and providing 20,000-v and 80,000-v output circuits; (b) video control amplifier units mounted on conventional racks and weighing 1200 lb; and (c) a picture projection unit which with its mounting trunnion weighs 400 lb. This by no means small extra weight of over a ton introduces a definite safety hazard to the building structure in many instances. Structural loading factors need to be thoroughly checked before the installation of such massive equipment.

Because of the high potentials produced by the voltage supply unit it is essential that it be located in a separate fireproof room with the entrance door closed and locked at all times. It is preferable to locate the unit as near as possible to the optical barrel which encloses the picture projection tube in order to reduce the required length of the special 80,000-v cable which connects to the second anode of the picture tube.

The video amplifier unit is mounted on two racks occupying a floor space 40 in. wide and 18 in. deep extending to a height of 64 in. in the theater projection room. It contains a television receiver, monitor panel, control panels, low-voltage power supplies and other miscellaneous operating units. While required projection-room space is not large, the room dimensions should provide enough to avoid overcrowding and consequent reduction in normal operating safety factors.

The proper location of the picture projection tube and optical barrel is very important from the viewpoint of safety to the public and it is also a very important factor in securing best projection quality. The nominal "throw" from the projection unit to the screen is 60 to 65 ft. *In a typical installation,* a heavy steel platform was installed for mounting the optical unit. This platform was mounted on the front face of the first balcony rail in such a manner as to preclude any possibility of unauthorized persons having access to or coming in contact with the projection tube or any of its high-voltage terminals. In this position, the tube and optical barrel projected a 15 × 20 ft picture on the screen at a "throw" of 62 ft. In theaters having no balconies the projection unit must be supported from the floor or ceiling and, as in the case of balcony support, the mounting structure must be adequately designed to eliminate any possibility of either electrical or mechanical hazards to theater personnel or audience. The unit should be enclosed in such a manner that any corona or arcing due to dampness is not visible.

Presently available direct projection television equipment is very well designed from the viewpoint of having adequate safety disconnect switches at all points where dangerous potentials may be encountered. Switches are provided, for example, at the access door to the high-voltage power supply room,

Fig. 2. A typical large studio showing the possiblity of accommodating large numbers of people.

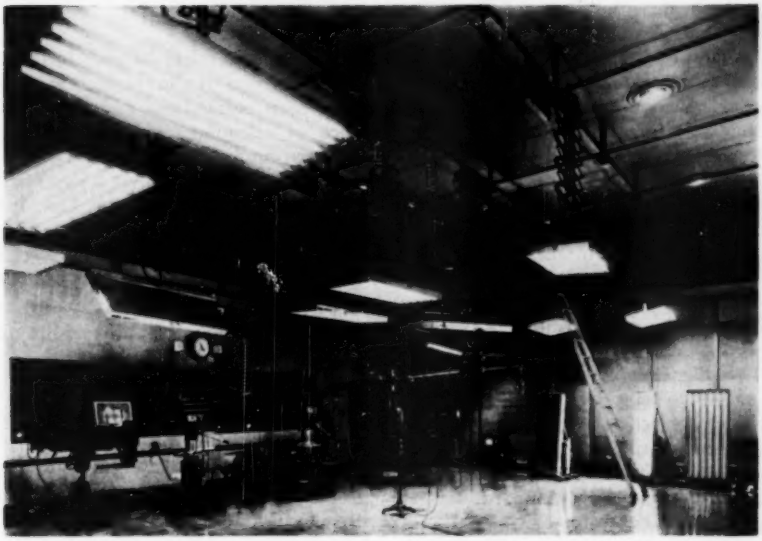


Fig. 3. A typical modern studio showing the extent of the special lighting equipment and other production apparatus which may be encountered.

on the enclosure for the picture projection tube and on various components of the amplifier and control equipment. It is extremely important that all of these safety circuits be intact at all times. Unauthorized modifications are the height of foolishness where potentials dangerous to life are concerned.

FILM METHOD FOR THEATER TELEVISION PROJECTION

This method, the so-called storage-type system, for television theater projection uses a 35mm motion picture camera to photograph a negative image on a television receiver to produce a direct-positive print. The exposed film is transported continuously to equipment for rapid development and drying. From this equipment it is transported to the projector for immediate projection on the theater screen. The elapsed time from the television camera pickup at the scene of action to the time of projection of the completed positive print on the theater screen is 61 sec.

This method requires a properly ventilated room of fireproof construction for the television receiver, the 35mm picture camera with a magazine which may contain 12,000 ft of unexposed film, and for the developing and drying equipment. This room obviously must be adjacent to the theater projection room and provision must be made for feeding the completed positive print to the upper fire valve rollers of the theater projector, from which the upper magazine has been removed. This arrangement of equipment will provide a continuous projection of motion pictures on the theater screen for more than two hours' duration.

From the viewpoint of safety, the present method used for feeding the processed print to and across the theater projection room to the projector head on a series of open pulleys could hardly be considered as complying with the most elementary standards for safe handling of 35mm film.

With the take-up magazine and the take-up device on the projector designed for only approximately 2000 ft of film, it is obvious that cutting of the film at the end of each 2000 ft will be required. The running end of the film must quickly be attached to the hub of an empty reel and the excess film on the projection-room floor must be spun onto the hub, after which the reel must be placed into position on the take-up spindle of the lower magazine for taking up the succeeding 2000 ft of film. This procedure must be repeated five times during the continuous projection of 12,000 ft of film. Such a procedure does not appear to follow any of the long-standing practices for the safe handling of motion picture film.

Conclusions

Some of the safety hazards in theater and television studio projection rooms have been pointed out and the importance of adequate corrective measures has been emphasized. The special safety precautions developed over a long period for theater projection rooms have been shown to be sensible and desirable without regard to the ignition characteristics of the film used, and the same considerations are shown to be applicable also to television studio projection rooms. Special hazards in television studios have been outlined. Theater television equipment, which presents safety hazards of new types, has been discussed and attention has been called to some of these in the hope that full knowledge of them will aid in their eventual elimination.

Military-Type Lenses for 35mm Motion Picture Cameras

By PAUL C. FOOTE and R. E. MIESSE

A new series of lenses for 35mm motion picture cameras has been designed as the first to primarily meet the many detailed requirements of military use. These are designated by the name Miltar, and represent the achievement of new goals. It has been a joint development by two companies who pooled resources and experience to provide a series in a minimum of time and cost with high performance. Many mechanical features have been combined with top optical performance to provide dependable operation over a wide range of conditions.

1. General Description

The Miltar series of lenses was planned to incorporate features required for military use, but not generally provided in lenses made for commercial or studio use. In specifications for either lenses or cameras appear requirements for vibration, humidity and temperature range tests more stringent than any commercial needs, which were considered in all details of the design of these lenses. Wherever possible, the recommendations of MIL-STD-150 were followed. In the specification list of lens types, these are: "Type V, for 35mm motion picture cameras."

The series is available in black for general use, as shown in Fig. 1. There is also a series in gray for the A-6 Camera, a portable 35mm motion picture camera for the Government services.

The equivalent focal lengths of the lenses in the series are based on a modified geometric progression of approximately $\sqrt{2}$, or 1.4× intervals, which give an area change of 2 from one lens to the next (Fig. 2). These are:

1-in., 25mm	4-in., 100mm
1.4-in., 35mm	6-in., 152mm
2-in., 50mm	10-in., 254mm
3-in., 75mm	

The 3-in. and 6-in. depart slightly from the exact values in the series because of the previous use of these focal lengths, and the 10-in. was included for the same reason. The first production included all but the 1.4-in. and 3-in., but these are now available.

The focal length of all lenses has been coded by the use of dots just ahead of the word "feet" on the focusing jacket in order that matched pairs, for stereo or other uses, could be picked from production lots without needing further

Presented on April 22, 1952, at the Society's Convention at Chicago, Ill., by Paul C. Foote, Bell & Howell Co., 7100 McCormick Rd., Chicago 45, Ill., and R. E. Miesse, General Scientific Corp., 5151 W. 65 St., Chicago, Ill.

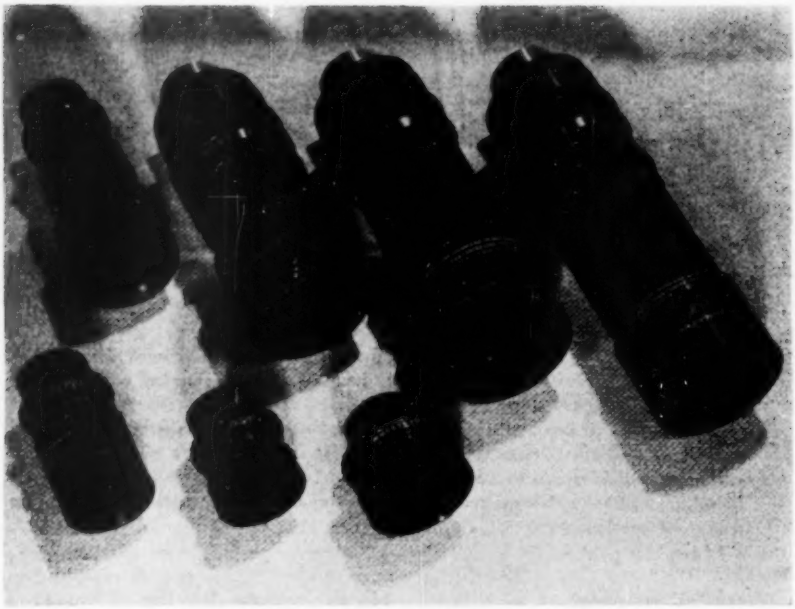


Fig. 1. Miltar Series in black for general use.

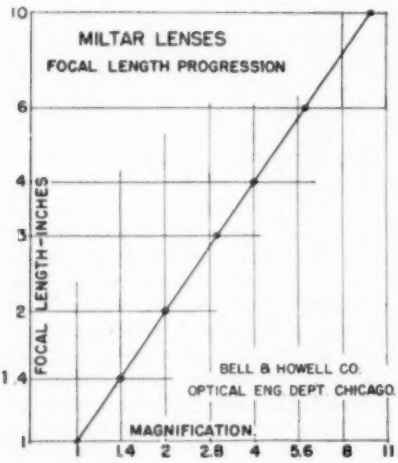


Fig. 2. Graph of effective focal length and magnification steps.

measurements. It keeps high focusing scale accuracy without individual calibration. Focal lengths are segregated into three groups, which are

plus 2% to plus 1%, three dots,
plus 1% to minus 1%, one dot, and
minus 1% to minus 2%, two dots,

and assembled into the focusing jackets that have been engraved, particularly for each group, and coded in accordance with the above ranges. The majority of the lenses fall into the nominal group: plus 1% to minus 1%, one dot.

These lenses are mounted in the military standard mount (Fig. 3) also identified as the Bell & Howell Eyemo mount, but they will also be available unmounted, or mounted in studio-type focusing jackets for the Bell & Howell Design 2709, the Mitchell, Wall or other cameras.

2. Optical Characteristics

In mapping out this Miltar series, some limitations were imposed on diameters to permit mounting lenses on existing camera turrets. The type of lens was then chosen to provide maximum performance. The 1-in. through 4-in. are 6-element construction of the Speed Panchro or Biotar form, with apertures of $f/2$, or T2.2.

The size restrictions limited the 6-in. to $f/3.5$, or T3.7, permitting the use of a well corrected triplet. The 10-in. is limited to $f/4.5$, or T4.9, and is a 4-element telephoto of standard form. In each case a special effort was made to use readily available domestic glass.

This glass, however, is held to closer than normal commercial index and dispersion tolerances.

The performance of all focal lengths is substantially increased over lenses previously supplied and is comparable to the best studio lenses. The aberrations have been corrected to give a crisp, high contrast image over the full frame.

The curves showing the aberration corrections are given in Figs. 4, 5, 6, 7, and 8. Part of the information is from the design data, part from actual measurements of production lenses.

No attempt is made here to quote resolution values, as the performance requirements of these lenses are based on results in specific cameras. Tests on spectroscopic plates do not give complete information, and tend to give a false appraisal of the practical values because of contrast differences.

Vignetting has been reduced on all focal lengths. This has required especially careful balancing of the oblique aberrations to obtain the improved contrast and resolution in the outer portions of the frame.

All air–glass surfaces are coated. Cemented elements will withstand the full temperature range and thermal shock requirements of the specifications.

3. Mechanical Characteristics

In the styling and general design, care was taken to give the lenses a matched series appearance. The diameters and physical lengths are in steps to correspond with the focal lengths and apertures. Special attention has been given the mounts and glass to obtain rugged construction for meeting thermal shock, temperature range, humidity, vibration and mechanical shock tests.

In designing this series to meet the drastic vibration requirements, every part is locked into its respective assembly with special antivibration sealing compounds and deep-set pilot screws, which again are locked into place so securely that they can only be removed by drilling.

The lenses are completely operable over the temperature range of -65 F to $+160$ F. All tolerances have been computed to offset the size changes for expansion and contraction through the temperature ranges.

A special noncorrosive lubricant is used which is not affected by these changes. This lubricant has a vapor pressure so low at 160° that no deposit on the glass is detectable after sustained operation at that temperature.

The diaphragm blades are lubricated with an unusual type of material, guaranteeing perfect operation over the full temperature range, with a long operating life. It has the properties of being anti-icing and noncongealing, at extremely low temperatures. Globules of condensed moisture will not freeze to the leaves, and the lubricant itself will not allow any of the leaves to bind together.

All metal parts, internal and external, are finished for high corrosion resistance. All aluminum parts are black anodized. Antireflection scoring and a durable optical black are used on all surfaces where required, internally and externally. A high-quality baked synthetic enamel is bonded to exterior

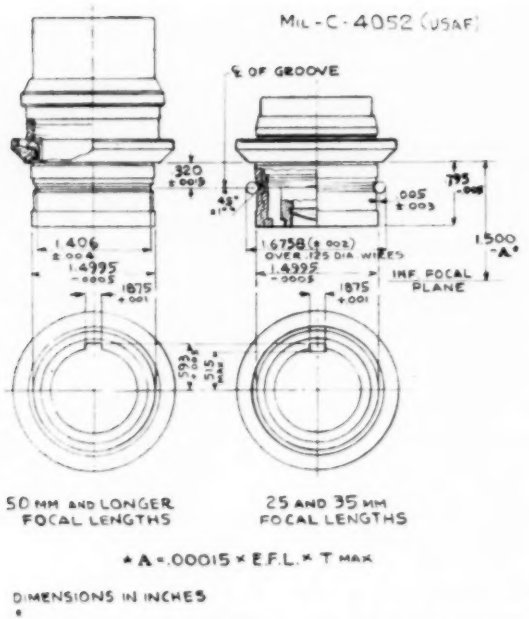


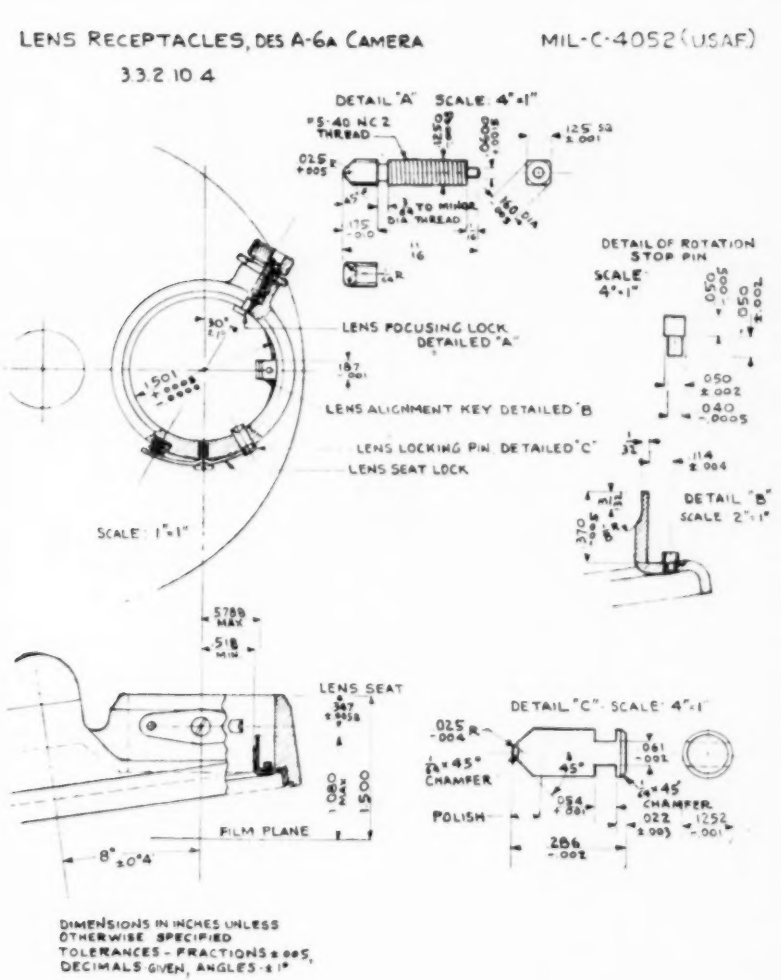
Fig. 3. Lens and camera mounting dimensions from MIL Specification.

parts, resulting in a finishing system that is extremely durable.

At present, the series is available in two external enamel finishes: gray, to match a camera on which they are used; and black, for general service use.

All control rings are adequately separated and are made as large as diameter clearances permit, with broad spaced knurls that facilitate easy manipulation, even though the operator may be wearing gloves. Focusing and iris scales are marked in easily read characters, especially designed (for all Bell & Howell lenses, not limited to this series) to prevent confusion of such characters as 3, 6 and 8, etc. The markings include full identification of the lens, its type, focal length in both inches and millimeters, filter size, sunshade thread, etc. The iris and focusing scales are designed to be read from the camera end. The lens name and filter information is designed to be read from the front of the lens.

Special provision has been made to mount standard sized filters between sunshade and lens in a convenient recess divided between both, so when the sunshade is screwed in, the filter is trapped, and protected by the sunshade (Fig. 9). The filter can be easily inserted regardless of the position of the camera. If the lens is pointed down or held on the level, the filter can be dropped into the recess on the sunshade, and the sunshade screwed into the lens. If the lens is pointed up, the filter can be dropped into the recess on the lens mount, then trapped when the sunshade is screwed into place. The filter sizes are recognized industry standards (Table I). The lens mounts have been designed to use as few sizes as possible. Four are required for this entire series: 1 using size 5, 2 using size 6, 1 using



size 7, 3 using size 8. Thread sizes and mount diameters have been kept to military and ASA standards. The sunshades have also been standardized to these specifications and marked with the filter size they retain.

Click stops are provided on the iris scales to prevent accidental movement and provide easily identified positioning. Lenses are available in either *f*/stops or individually transmission-calibrated

Table I. Filters.

Size No.	Nominal Size, in.	Max. O.D. in.	Max. O.D. mm	Max. Thickness in.	Max. Thickness mm
5	1	1.198	30.43	0.175	4.45
6	1½	1.634	41.5	0.195	4.95
7	2	2.006	50.95	0.219	5.55
8	2½	2.506	63.65	0.226	5.75

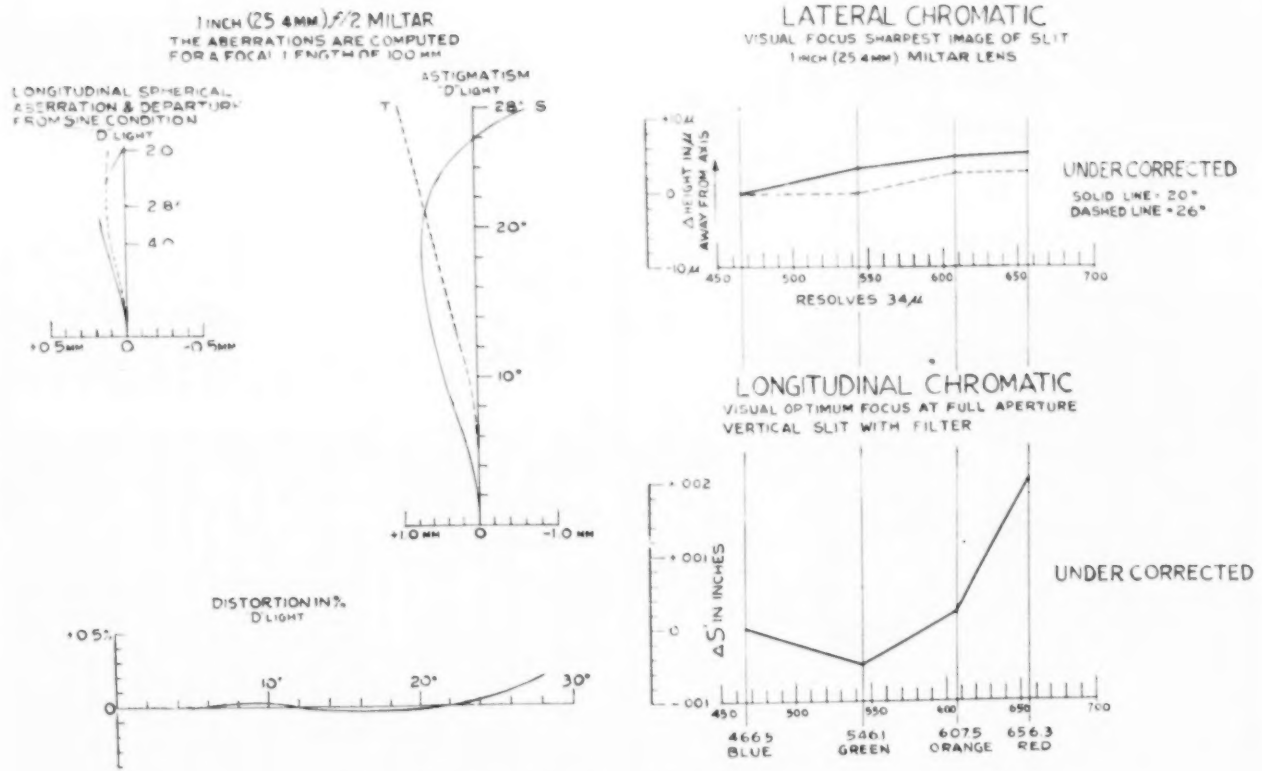


Fig. 4. Optical characteristics of 1-in. lens.

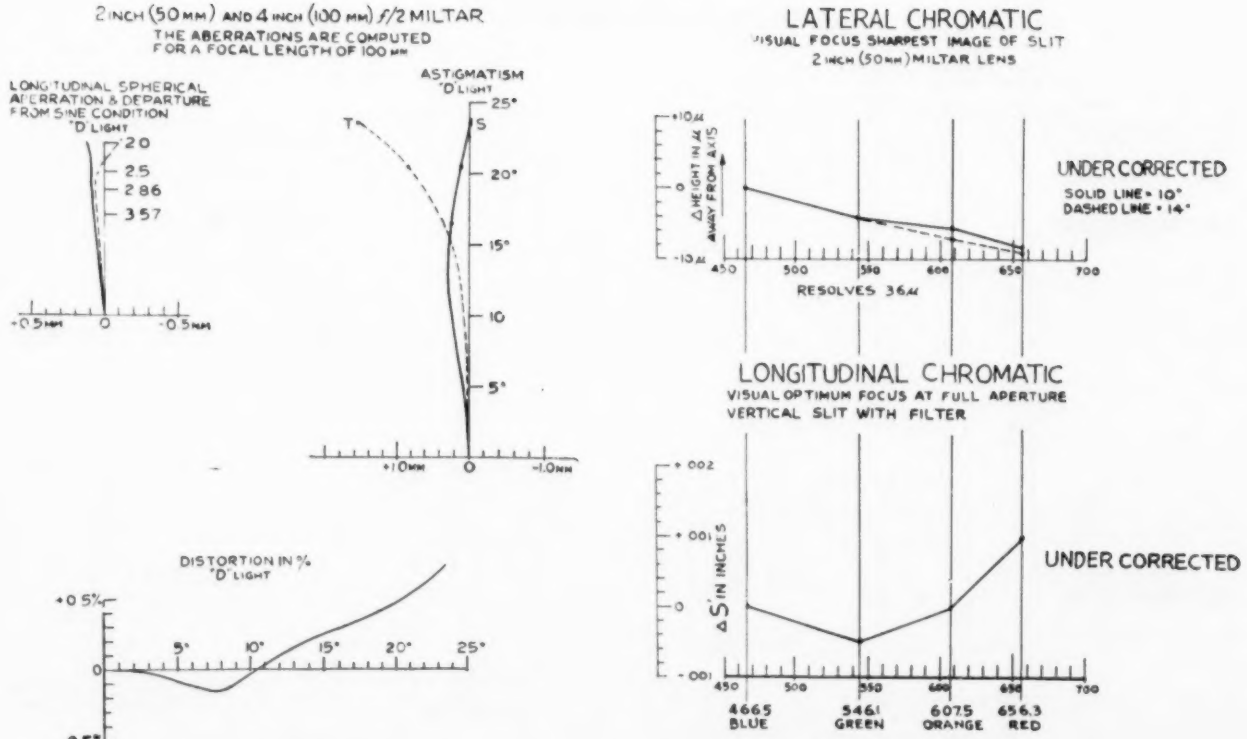


Fig. 5. Optical characteristics of 2-in. lens.

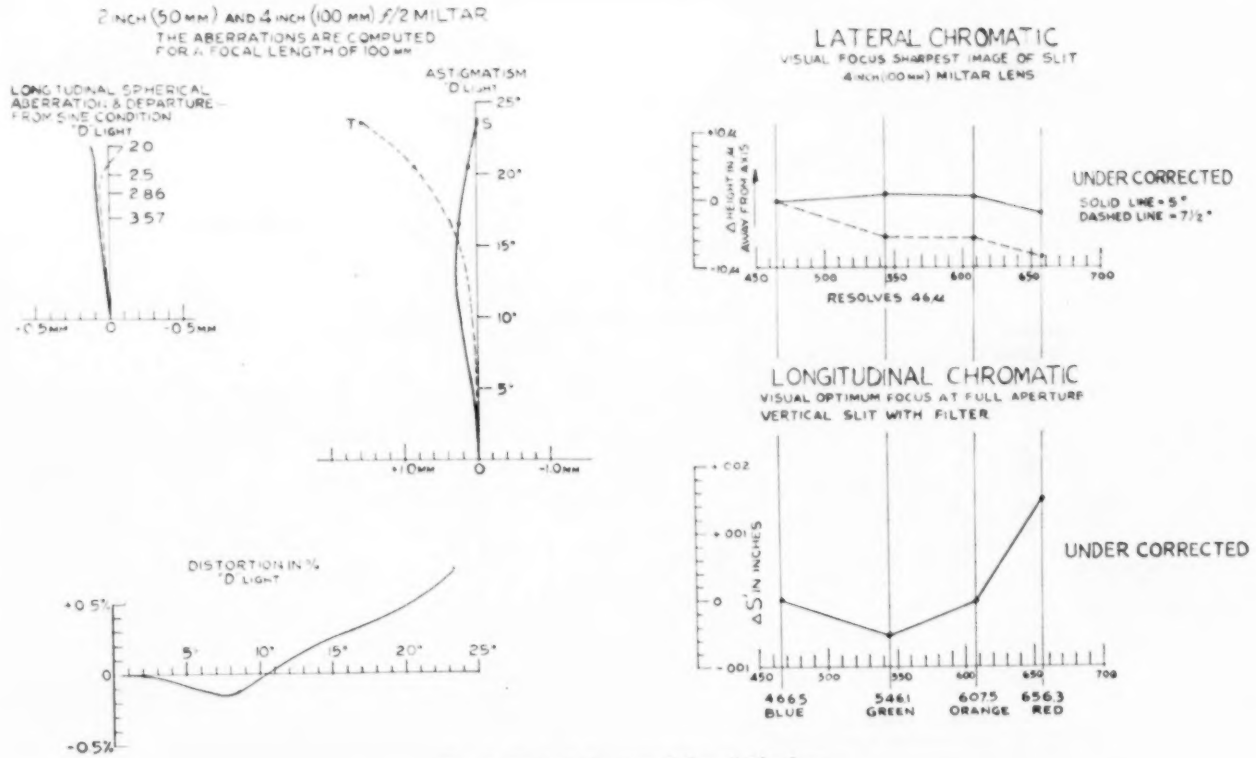


Fig. 6. Optical characteristics of 4-in. lens.

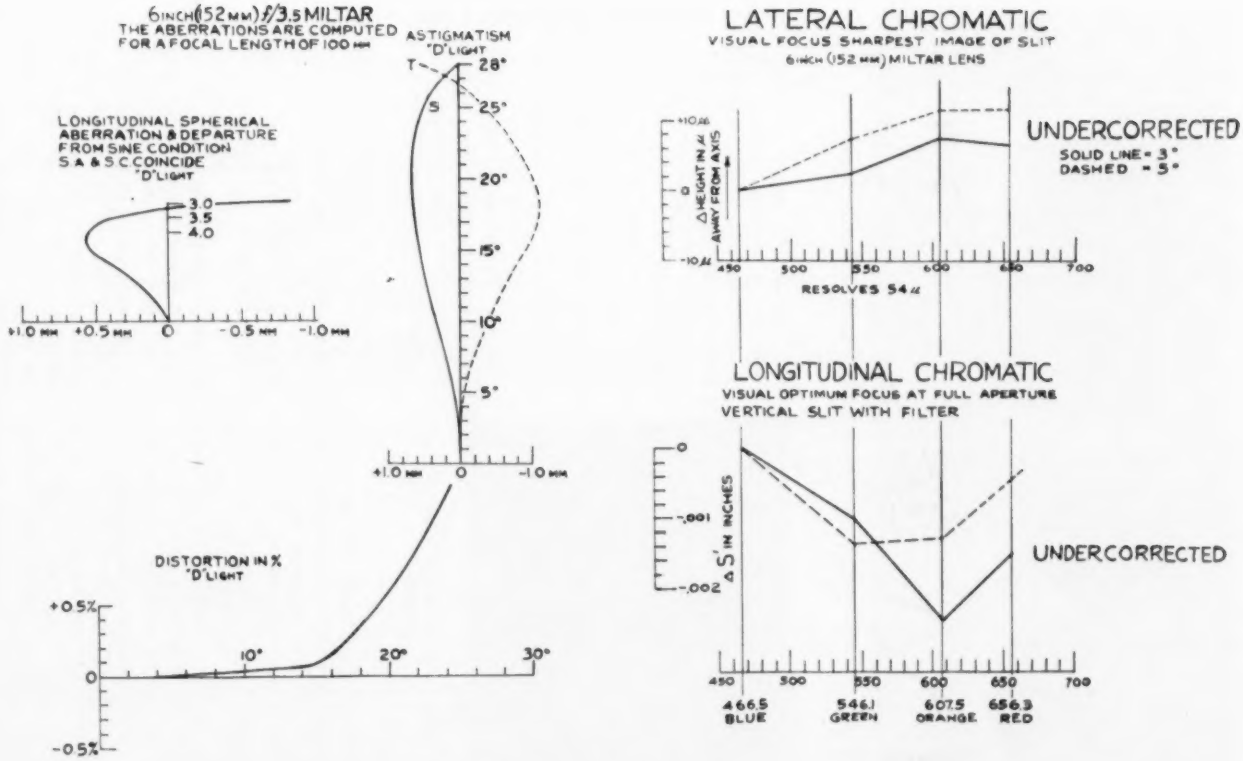


Fig. 7. Optical characteristics of 6-in. lens.

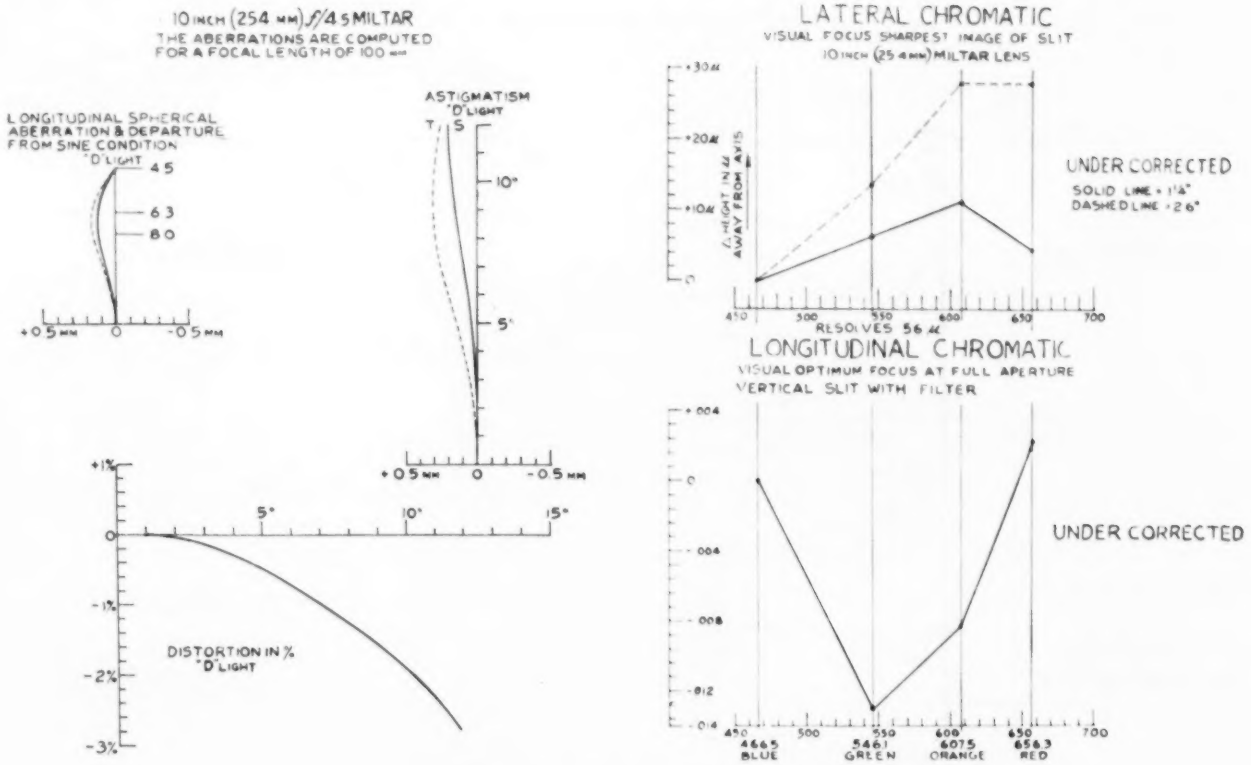


Fig. 8. Optical characteristics of 10-in. lens.

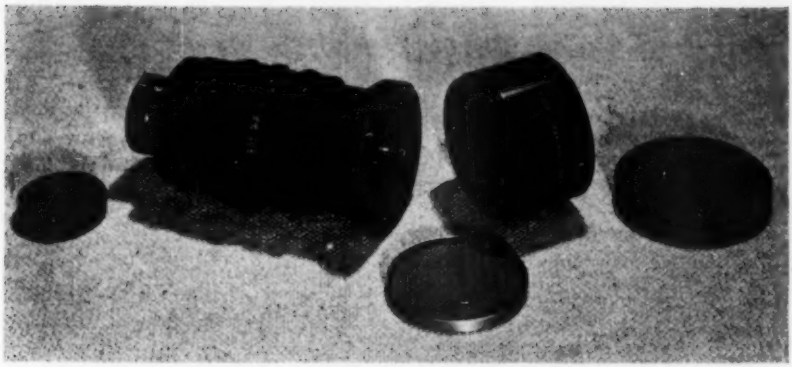


Fig. 9. The 4-in. lens, showing caps, sunshade and filter.

T stops. All scales are spread with uniform spacing between stops. This has been obtained by the use of a modified L-shaped iris leaf. Iris and focusing scales either work to a common index line, or to index lines on the same axis. Locks have been provided to clamp the focusing mount at any position. All distances are measured to the focal plane.

Two types of mount are provided. For the 3-in. and shorter lenses, these are the same as previously supplied, only of a much sturdier construction, and the focusing and iris rings have been brought forward from the camera for better accessability. On these mounts, the focusing is accomplished by rotating the focusing sleeve between the lens and the mount on the camera. A key in the camera keeps the lens from rotating. The focus position is locked by the clamp screw normally provided on the camera.

For the 4-in. and longer lenses, an entirely new focusing mount has been developed, common to all three lenses. A stainless steel adapter mounts the entire assembly into the camera, and is locked in position by the camera clamp-screw. The focusing action is independent of this. The key orients the lens to bring focusing and iris index marks into the operating position (Fig. 10). Stainless steel was chosen because of its high shearing modulus and its ability to withstand fatigue at the junction between the camera turret and the lens body. Further, it is electrolytically inert with the camera turret. A red dot is placed on the flange focusing seat of the adapter in direct line with the bayonet slot, which enables the easy mating of the slot and the bayonet when inserting the lens into the camera.

Fig. 10. Rear view of 2-in. and 4-in. lenses.

A square aperture in the adapter which allows added internal clearance for the light beam to the corners of the

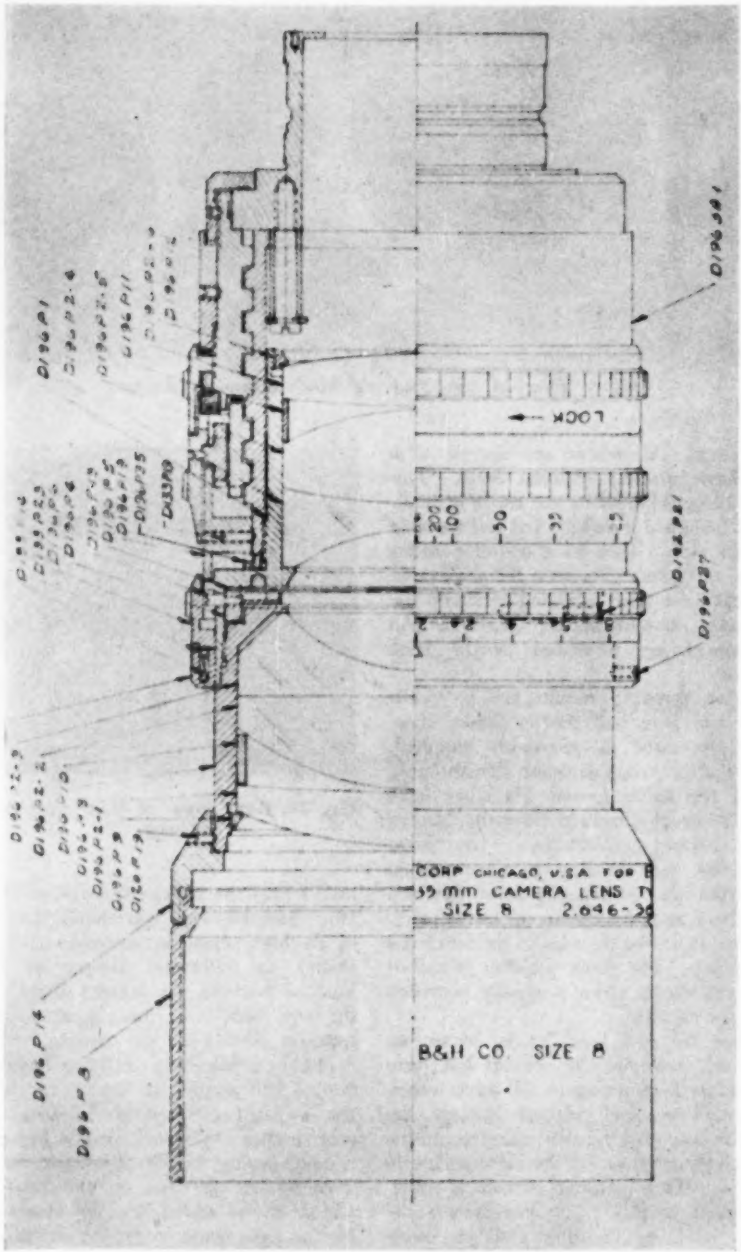


Fig. 11. Cross section of 4-in. lens.

frame is positioned by taking advantage of the slot.

The focusing jacket deserves special comment. Because of the weight of the lenses, a sturdy mount is required (Fig. 11). The focusing threads are nominally square, but the sides have a few degrees taper for ease of manufacturing, and to provide a good fit. They have been perfection-lapped with special noncharging compounds in order to maintain smooth operation and long life at all temperatures.

The outer sleeve is made in two separated sections, spring loaded for accurate positioning. The focusing lock, when applied, operates in the same direction as the loaded spring; thus, a rigid, exact station of focus is acquired. When the knurled lock ring behind the focusing ring is turned, the floating section of the sleeve is pushed away from the main stationary section, clamping the threads axially on the internal sleeve or screw.

These lenses are all flange focused on an internal flange. Consequently, there is no defacing of any outside surfaces. The trimming dimension is held within plus or minus 1/20 of 1%, to plus or minus 1/33 of 1%, depending on the particular focal length of the lens in the series. Special equipment had to be designed in order to measure and maintain these very close dimensions.

Provision has been made to add Depth of Field Scales when required.

A new design dust cap is provided (Table II). It is black molded cold-resistant synthetic rubber with a metal insert, giving the stiffness and protection of an all-metal cap and the grip of a rubber cap. Because of size standardization, each cap fits the lens with or without the sunshade.

Table II. Lens (Dust) Caps.

Size No.	For Diameters in.	mm
6	1.870	47.5
7	2.244	57.0
8	2.744	69.7

The following tabulation gives lens nomenclature, mount characteristics, and accessory sizes:

1-in. (25.5mm) f/2 (T2.2)
Focuses from infinity to 1 ft
Iris calibrated from *f*/2 to *f*/22 (T2.2 to T22)
Filter size 6 (1¼ in.)
Sunshade size 6–7
Cap size 7

1.4-in. (35mm) f/2 (T2.2)
Focuses from infinity to 1.5 ft
Iris calibrated from *f*/2 to *f*/22 (T2.2 to T22)
Filter size 5 (1 in.)
Sunshade size 5–6
Cap size 6

2-in. (50mm) f/2 (T2.2)
Focuses from infinity to 2.5 ft
Iris calibrated from *f*/2 to *f*/22 (T2.2 to T22)
Filter size 6 (1¼ in.)
Sunshade size 6
Cap size 6

3-in. (75mm) f/2 (T2.2)
Focuses from infinity to 5 ft
Iris calibrated from *f*/2 to *f*/22 (T2.2 to T22)
Filter size 7 (2 in.)
Sunshade size 7
Cap size 7

4-in. (100mm) f/2 (T2.2)
Focuses from infinity to 4 ft
Iris calibrated from *f*/2 to *f*/22 (T2.2 to T22)
Filter size 8 (2½ in.)
Sunshade size 8
Cap size 8

6-in. (152mm) f/3.5 (T3.7)
Focuses from infinity to 10 ft
Iris calibrated from *f*/3.5 to *f*/22 (T3.7 to T22)
Filter size 8 (2½ in.)
Sunshade size 8
Cap size 8

10 in. (254mm) f/4.5 (T4.9)
Focuses from infinity to 25 ft
Iris calibrated from *f*/4.5 to *f*/22 (T4.9 to T22)
Filter size 8 (2½ in.)
Sunshade size 8
Cap size 8

In the design of these lenses, special engineering and manufacturing techniques have been applied, which insure concentricity. The factors contributing most to these goals are:

1. The Optical Centering of the Elements: Special equipment assures a high degree of accuracy in centering before and after cementing.

2. The Alignment of the Elements in Their Cells: The basic geometry of the thick edges, plus thick spacers, and the parallel seats, assure an optical-mechanical self-alignment with remarkable accuracy and without imposing impossible tolerances.

3. The Smooth Fit of the Threads: No threads are generated by taps and dies. Retaining ring threads are chased parallel and square to the bore.

4. The Piloting of Cells and Focusing Mounts: Where higher accuracy is required, pilots and threads are used. The threads only to retain, and the pilots to guide and locate. Operational threads are lapped.

All of this is obtained without a sacrifice to production possibilities. The parts are held to such precision that there is an absolute minimum of hand fit required, which in turn insures a production in keeping with any normal requirements that could be placed upon us within the realm of reason or economic limits.

Patents have been applied for on all of these lenses. Due to the newness of this development, sufficient time has not elapsed to receive patent office action.

While being currently supplied to the military services, it is felt that this series contains features of value to others and so will be commercially available.

The authors wish to give special commendations to the staffs of both General Scientific Corp. and Bell & Howell Co. for the splendid help in the design, development, testing and production of the Miltar lenses.

Discussion

John D. Hayes (Bausch & Lomb Optical Co.): I'd like to ask the authors how they obtained sealing for humidity around the iris diaphragm slot in the barrel?

Mr. Foote: There is no sealing for humidity. The operational requirements of the lens do not specify that in this particular case.

CORRECTION — PH22.11–1952
16Mm Motion Picture Projection Reels

IN THE PROCESS of revising Z22.11, several drafts were considered by the 16mm and 8mm Motion Pictures Committee. In December 1949, SMPE 121 was issued containing a misplaced decimal point in the lateral runout dimension of 200-ft reels (Table 2). Thus, the correct dimension of .057 in. was given as 0.57 in. This error was discovered only after the final approved standard was published in the June 1952 *Journal*. The standard is therefore now being republished as originally intended.

In addition, the diagram has been changed slightly to show the flanges flat instead of flared to preclude any misunderstanding that the edges must be rolled or flared. The words "if any" have been added at the end of the note after "S" in the table of dimensions to make that clear.

American Standard

for

16-Millimeter Motion Picture Projection Reels

ASA
Reg. U. S. Pat. Off.
PH22.11-1952
Revision of
Z22.11-1941
and
Z52.33-1945
*UDC 778.55

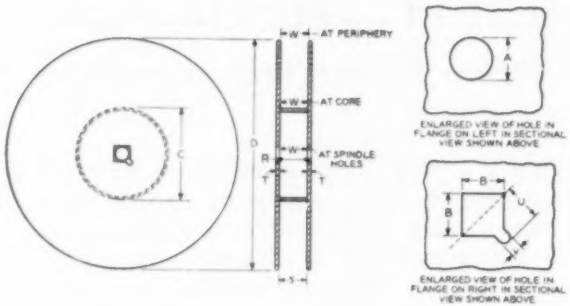


Table 1 See page 3 for notes.

Dimension	Inches	Millimeters
A	0.319 $^{+0.000}_{-0.003}$	8.10 $^{+0.00}_{-0.08}$
B	0.319 $^{+0.000}_{-0.003}$	8.10 $^{+0.00}_{-0.08}$
R[1]	0.790 maximum	20.06 maximum
S[2] (including flared, rolled, or beveled edges, if any)	0.962 maximum	24.43 maximum
T (adjacent to spindle)	0.027 minimum 0.066 maximum	0.69 minimum 1.68 maximum
U	0.312 ±0.016	7.92 ±0.41
V	0.125 $^{+0.005}_{-0.000}$	3.18 $^{+0.13}_{-0.00}$
W, at periphery[3]	0.660 $^{+0.045}_{-0.025}$	16.76 $^{+1.14}_{-0.64}$
at core[4]	0.660 ±0.010	16.76 ±0.25
at spindle holes	0.660 ±0.015	16.76 ±0.38
Flange and core concentricity[5]	±0.031	±0.79

Approved April 30, 1952, by the American Standards Association, Incorporated
Sponsor: Society of Motion Picture and Television Engineers
*Universal Decimal Classification

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American Standard
for
16-Millimeter Motion Picture Projection Reels

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PH22.11-1952

Table 2

Capacity	Dimension	Inches	Millimeters	Capacity	Dimension	Inches	Millimeters
200 feet[6] (61 meters)	D, nominal	5.000	127.00	1200 feet (366 meters)	D, nominal	12.250	311.15
	maximum	5.031	127.79		maximum	12.250	311.15
	minimum	5.000	127.00		minimum	12.125*	307.98*
	C, nominal	1.750	44.45		C, nominal	4.875	123.83
	maximum	2.000*	50.80*		maximum	4.875	123.83
	minimum	1.750	44.45		minimum	4.625*	117.48*
	Lateral runout,[7] maximum	0.057	1.45		Lateral runout,[7] maximum	0.140	3.56
400 feet[6] (122 meters)	D, nominal	7.000	177.80	1600 feet (488 meters)	D, nominal	13.750	349.25
	maximum	7.031	178.59		maximum	14.000*	355.60*
	minimum	7.000	177.80		minimum	13.750	349.25
	C, nominal	2.500	63.50		C, nominal	4.875	123.83
	maximum	2.500	63.50		maximum	4.875	123.83
	minimum	1.750*	44.45*		minimum	4.625*	117.48*
	Lateral runout,[7] maximum	0.080	2.03		Lateral runout,[7] maximum	0.160	4.06
800 feet (244 meters)	D, nominal	10.500	266.70	2000 feet (610 meters)	D, nominal	15.000	381.00
	maximum	10.531	267.49		maximum	15.031	381.79
	minimum	10.500	266.70		minimum	15.000	381.00
	C, nominal	4.875	123.83		C, nominal	4.625	117.48
	maximum	4.875	123.83		maximum	4.875	123.83
	minimum	4.500*	114.30*		minimum	4.625	117.48
	Lateral runout,[7] maximum	0.120	3.05		Lateral runout,[7] maximum	0.171	4.34

*When new reels are designed or when new tools are made for present reels, the cores and flanges should be made to conform, as closely as practicable, to the nominal values in the above table. It is hoped that in some future revision of this standard the asterisked values may be omitted.

American Standard
for
16-Millimeter Motion Picture Projection Reels

ASA Reg. U. S. Pat. Off.

PH22.11-1952

Note 1: The outer surfaces of the flanges shall be flat out to a diameter of at least 1.250 inches.

Note 2: Rivets or other fastening members shall not extend beyond the outside surfaces of the flanges more than 1/32 inch (0.79 millimeter) and shall not extend beyond the over-all thickness indicated by dimension S.

Note 3: Except at embossings, rolled edges, and rounded corners, the limits shown here shall not be exceeded at the periphery of the flanges, nor at any other distance from the center of the reel.

Note 4: If spring fingers are used to engage the edges of the film, dimension W shall be measured between the fingers when they are pressed outward to the limit of their operating range.

Note 5: This concentricity is with respect to the center line of the hole for the spindles.

Note 6: This reel should not be used as a take-up reel on a sound projector unless there is special provision to keep the take-up tension within the desirable range of 1½ to 5 ounces.

Note 7: Lateral runout is the maximum excursion of any point on the flange from the intended plane of rotation of that point when the reel is rotated on an accurate, tightly fitted shaft.

American Standard
for
16-Millimeter Motion Picture Projection Reels

ASA
Reg. U. S. Pat. Off.

PH22.11-1952

Appendix

(This Appendix is not a part of the American Standard for 16-Millimeter Motion Picture Projection Reels, PH22.11-1952.)

Dimensions A and B were chosen to give sufficient clearance between the reels and the largest spindles normally used on 16-millimeter projectors. While some users prefer a square hole in both flanges for laboratory work, it is recommended that such reels be obtained on special order. If both flanges have square holes, and if the respective sides of the squares are parallel, the reel will not be suitable for use on some spindles. This is true if the spindle has a shoulder against which the outer flange is stopped for lateral positioning of the reel. But the objection does not apply if the two squares are oriented so that their respective sides are at an angle.

For regular projection, however, a reel with a round hole in one flange is generally preferred. With it the projectionist can tell at a glance whether or not the film needs rewinding. Furthermore, this type of reel helps the projectionist place the film correctly on the projector and thread it so that the picture is properly oriented with respect to rights and lefts.

The nominal value for W was chosen to provide proper lateral clearance for the film, which has a maximum width of 0.630 inch. Yet the channel is narrow enough so that the film cannot wander laterally too much as it is coiled; if the channel is too wide, it is likely to cause loose winding and excessively large rolls. The tolerances for W vary. At the core they are least because it is possible to control the distance fairly easily in that zone. At the holes for the spindles they are somewhat larger to allow for slight buckling of the flanges between the core and the holes. At the periphery the tolerances are still greater because it is difficult to maintain the distance with such accuracy.

Minimum and maximum values for T, the thickness of the flanges, were chosen to permit the use of various materials.

The opening in the corner of the square hole, to which dimensions U and V apply, is provided for the spindles of 35-millimeter rewinds, which are used in some laboratories.

D, the outside diameter of the flanges, was made as large as permitted by past practice in the design of projectors, containers for the reels, rewinds, and similar equipment. This was done so that the values of C could be made as great as possible. Then there is less variation, throughout the projection of a roll, in the tension to which the film is subjected by the take-up mechanism, especially if a constant-torque device is used. Thus it is necessary to keep the ratio of flange diameter to core diameter as small as possible, and also to eliminate as many small cores as possible. For the cores, rather widely separated limits (not intended to be manufacturing tolerances) are given in order to permit the use of current reels that are known to give satisfactory results.

72d Semiannual Convention

The Tentative Program, mailed to all members on August 29, shows the schedule for 86 papers and Committee Reports. Sixteen Committee Meetings will be held during the week. Of the 86 papers, 41 are for the International Symposium on High-Speed Photography which is scheduled to begin on Wednesday morning, October 8, with successive sessions originally scheduled through Friday forenoon. Current developments may require Program Chairman Joe Aiken to revise this so that the Symposium is carried through Friday afternoon. In that case, the last three papers scheduled for Thursday afternoon at the Naval Ordnance Laboratory may be moved to a Symposium session, and certain special motion picture papers would be scheduled for the Naval Ordnance Laboratory Session. For the NOL Session, note this advice repeated from the Tentative Program:

All individuals who wish to go on the trip to the Naval Ordnance Laboratory on Thursday, must register for it prior to noon Tuesday, October 7. Those who wish to attend this session, but who cannot register before noon Tuesday, must write their intention to Joseph E. Aiken, 116 N. Galveston St., Arlington 3, Virginia, and state if they are citizens of the United States.

All non-citizens of the United States must receive a special clearance for the Naval Ordnance Laboratory visit. This may be obtained by writing to their embassy in Washington, prior to the Convention, requesting that they be cleared for this visit to the Chief of Naval Operations, who will in turn notify the Naval Ordnance Laboratory.

Plans for the first two days remain essentially the same as in the Advance Postal Card Notice — Television Sessions on Monday afternoon and evening and on Tuesday forenoon and afternoon, and a General Motion Pictures Session Tuesday evening.

Those who do not yet have hotel reservations should write Air Mail or wire Mr. H. C. Blunck, Manager, Hotel Statler, Washington, D.C. Ask Society headquarters for information or copies of the Tentative Program if you would like such.

Board of Governors Meeting

A major portion of the Society's Board Meeting on July 17 was a continuation and reflection of what was previously reported as "Most significant administrative development of 1951 . . ." (report of this year's first Board Meeting). This has been the appointment and operation of an Executive Committee.

From the Executive Committee's attention to some major details and aspects of the Society's operation have come logically and with minimum pain several summations of points of policy for the Board's consideration. The Board also reviewed the initial outline of a study of the costs of membership service and of the costs of securing new members. Action was taken on the resignation of one Society Officer and policy was carefully reviewed in regard to another office.

The Executive Committee has been studying and reviewing some legal problems, accounting policies, test film operations and possibilities for a project control scheme that would formalize the course of Society projects. These Board actions have resulted in Proposed Bylaws.

One proposed additional Bylaw records the long-established underlying policy that Standards and Recommendations developed by the Society are of a voluntary nature. The other Bylaw meets the legal technicality of providing for a procedure for disposition of assets in case of dissolution. These proposals were explained in detail in the August *Journal*, p. 153.

Test Films

The Board reaffirmed the Society's policy of developing and supplying test films on a no-profit, no-loss basis. The appropriate officers and employees were instructed to make whatever cost accounting analyses, surveys and sales forecasts are necessary to maintain the policy of supply-

ing test films as a part of the Society's general program for the development of technical and engineering standards.

Membership Cost Study

The Executive Secretary presented a brief report of progress on the Headquarters' cost study of membership service, explaining that this first official attempt to separate the Society's various operations for the purpose of cost analysis was encouraging. Comparisons were drawn between dues paid by the average member and cost of services rendered, and then between the first year's dues of a new member, the cost to secure each additional new member, and the added cost to the Society of services rendered to a new member during his first year. It is expected that the completed study will be the basis for detailed planning of the many Society activities.

Finances and Budget

The six-month reports of the Financial Vice-President and the Treasurer were approved. The Executive Secretary made a preliminary report on the 1953 budget, and the Board made recommendations as the basis for further budget planning, so that a proposed 1953 budget can be considered at its next Meeting. The initial budget planning was based on the advice of the officers of five groups of activities: engineering, conventions, publications, sustaining memberships, and general membership promotion. They were asked for their advice for 1953 compared with 1952 and the three preceding years. Expense items which are policy-controlled were the subjects of study.

Resignation of F. T. Bowditch

Mr. Bowditch had reported to the Society's President on June 13 that an emergency situation at National Carbon Company required his attention to new duties and his relinquishing the Society's Engineering Vice-Presidency. The Board regretfully accepted the resignation to be effective October 6 and appointed Henry J. Hood of Eastman Kodak to serve from October 6, 1952, through December 31, 1953. Something of the scope of Mr. Bowditch's service to the Society is given later in this *Journal* under "Engineering Activities," and in the report opening this *Journal*.

Nominations and Other Reports

With one exception, the roster of nominees for the Society's 1952 election was all cleared and was approved by the Board.

For the first time in 36 years there has had to be a change in the nominee for Convention Vice-President. The Nominating Committee had cause for pause: since 1916, the Society has had "Conventions by Bill Kunzmann"—so the Committee tossed into the lap of the Board the poser created by Bill Kunzmann's forthcoming retirement from National Carbon. The Board discussed at great length possibilities for revising the duties and lessening the travel and other demands made on the Convention Vice-President, but it was not possible within the long-established policies of the Society to work out a program that would enable Bill to accept the nomination. The Board, therefore, regretfully turned to the alternative of seeking another nominee and gave the job of finding someone to the Executive Vice-President and a committee of four. A number of suggestions were received and the final choice made was Jack Servies, Vice-President of National Theatre Supply. The nomination of Mr. Servies was approved by a letter ballot of the Board and his name completed the roster for the ballots which were mailed on August 25 to all voting members.

Reports of the Fellow Award and other award committees were received and approved. A complete account of awards will be given in a later *Journal*. Malcolm G. Townsley as chairman of a temporary committee to study the method of presenting awards reported that his group favored making all the presentations at the banquet. An informal report from John G. Frayne, Chairman of the 75th (Spring of '53) Convention Planning Committee, briefly described the program, which is to be based on an historical theme, with the likely extra costs for such a project being partially offset by sales of a proposed booklet. Important developments in motion pictures and television over the past fifty years would be covered in several technical sessions, with particular papers covering the field from the beginning to the very latest along technical lines.

Other reports approved were those of the Convention Vice-President, Editorial Vice-President and the three Section Chairmen.

Engineering Activities

Engineering Vice-President

Fred Bowditch, the Society's active and able Engineering Vice-President, has submitted his resignation, effective October 6, 1952. An increase in his responsibilities with National Carbon Co. no longer allows the time and attention that he feels the Engineering Vice-Presidency requires.

Long active in the engineering and standards work of the Society, Fred was elected Engineering Vice-President for 1950–52 and reelected for 1952–54. The diversity of his Society interests is indicated in the listing below, but this in no way begins to tell the story of the vital contributions he has made to the present healthy state of our engineering activities.

Committee	*Period*
Color	1940–44
Inter-Society Color Council	1940–52
Papers	1941–44
Progress	1941–45
Screen Brightness	1941
Standards, Chairman 1940–47	1941–52
Z22 (PH22), Chairman 1949–50	1946–52
Television	1947–49
Board of Governors	1949–52
Nominations	1949–52
Fellow Award	1950–52

We know that through his continued membership on several of the above committees he will maintain his close contact with the Society.

His successor will be Henry Hood of Eastman Kodak. Henry started his committee activity in 1945 as a member of the Non-Theatrical Equipment Committee. This was reorganized in 1948 as the Committee on 16mm and 8mm Motion Pictures with Henry as chairman. The committee blossomed under his leadership and in 1950 he was reappointed for a second two-year term, the maximum permitted by the Bylaws. At the conclusion of his second term and in recognition of his outstanding work, he was appointed Chairman of the Standards Committee. At the last meeting of the Board of Governors, July 17, Henry was appointed to complete the remainder of Fred's term of office.—*Henry Kogel*, Staff Engineer.

Atlantic Coast Section Regional Meeting at Atlanta

The Regional Meeting of the SMPTE Atlantic Coast Section held on Friday, May 9, in Atlanta, Ga., as a joint endeavor with the Atlanta Section of the IRE and the Atlanta Chapter of the AIEE, attracted an attendance of over 200 in the Hightower Textile Building Auditorium of the Georgia Institute of Technology. The arrangements for the meeting were made by E. M. Stifle, Chairman of the Atlantic Coast Section, assisted by Charles D. Beeland and Ben Akerman, both of Atlanta.

The program was:

Comparison of Definition in Television and Photographic Processes by Otto H. Schade, Tube Dept., Radio Corporation of America, Harrison, N.J.

Eastman Color Motion Picture Films by W. T. Hanson, Jr., Research Laboratories, Eastman Kodak Co., Rochester 4, N.Y.

Synchro-Lite Powered 16mm Film Projector for Television by R. E. Putnam and E. H. Lederer, Broadcast Studio Engineering Sec., Electronics Div., General Electric Co., Syracuse, N.Y.

Improved Television Film Reproduction by Vernon J. Duke and K. E. Mullenger, National Broadcasting Co., New York, *presented by* C. F. Daugherty, WSB-TV, Atlanta, Ga.

Lighting for Television, a film, by courtesy of CBS-TV, New York, produced by Paul Wittig and directed by Lela Swift.

Great interest was shown in this meeting. A number of requests have come in from persons who attended this meeting, asking for more similar meetings to be held in Atlanta. In addition to the large attendance from Georgia, engineers also came from the states of Alabama, Illinois, New Jersey, New York, South Carolina and Tennessee. — *E. M. Stifle*, Eastman Kodak Co., 342 Madison Ave., New York 17, N.Y.

Letters to the Editor

Re: Stereoptics Ltd. Cameras for Telecinema Film

My attention has been drawn to the article by Mr. R. Spottiswoode which appears in the April 1952 *Journal*.

In order to correct any misunderstanding which may, perhaps, have arisen in the minds of some readers, I would like to draw attention to the following points which Mr. Spottiswoode — no doubt unintentionally — has omitted to mention.

The principle of the stereo photographic equipment, embodying two cameras, supplied for the production of stereo films for the Festival of Britain Telecinema, was devised by the undersigned and the apparatus was supplied by one of my Companies—Messrs. Stereoptics Ltd. of London. Moreover, the principle involved is the subject of British Complete Patent Application No. 17,086/50 which, it is understood, is due for acceptance at an early date.

A full description of the apparatus was given in my paper "Stereoscopy in the Telekinema and in the Future" which I produced last year at the request of the British Kinematograph Society and which was published in that Society's Journal, *British Kinematography, 18:* pp. 172–181, No. 6, June 1952.

June 17, 1952

L. Dudley, Director
Stereoptics, Ltd.
Odeon Theatre
263 Kensington High St.,
London, W. 8, England

Note by Raymond Spottiswoode

One out of the four Telecinema pictures, *A Solid Explanation*, was shot with the aid of two film cameras of well-known make, mounted on a special base incorporating the patent Mr. Dudley refers to and designed and built under his company's direction. This film carries the credit title, "The equipment, incorporating cameras by Newman and Sinclair, Ltd., was developed by Stereoptics, Ltd."

July 12, 1952

Raymond Spottiswoode
Kingsgate
Sudbury Hill
Harrow-on-the-Hill
England

Book Reviews

Classrooms

No. 1 in a series, *Planning Schools for Use of Audio-Visual Materials*. Published (1952) by Department of Audio-Visual Instruction, National Education Association, 1201 Sixteenth St., N.W., Washington, D.C. 40 pp. 20 illus. Paper covered. 6 × 9 in. Price $1.00.

This is the first of a series of booklets on planning schools for the use of audio-visual aids.[1] Devoted entirely to the planning of classrooms for greatest efficiency, it is prepared as a guide to architects and other planners who are designing new schools or remodeling old classrooms. Various planning groups and manufacturers of audio-visual materials collaborated in preparing the text.

[1] D. F. Lyman, "Audio-Visual Instruction Conference," *Jour. SMPTE*, **58:** 445–449, May 1952.

The introduction states that it is generally recognized that the use of audio-visual materials greatly enriches the child's classroom education. Thus it prepares him better to meet the demands of the modern world. But it is not so well recognized that school buildings must be planned carefully by administrators, architects, faculties, patrons and builders, or the audio-visual program will be quite ineffective if not impossible. The classroom is considered in this first study because it is the first and most important part of the building to equip properly.

By far the chief function of the book is to describe methods of darkening the classroom to insure good tonal quality in the projected picture. Several ways of darkening the room are described: drapes, opaque shades, venetian blinds, louvres and jalousies. Drawings and photographs of

actual installations clarify the text. Of great practical value is the list of 36 companies that produce or distribute materials for this purpose.

One short section describes the requirements for adequate ventilation of the darkened classroom. Other sections show the proper ways to select, mount and use the projection screen. There are specifications for projection stands, placement of loudspeakers, switches, receptacles, and conduits to connect the classroom with the central sound and television system. A brief section on acoustics states the fundamental problems simply and clearly, with references to other authorities for more detailed information.

Specifications for display facilities and project areas for small groups emphasize the importance of considering other audio-visual aids. Another short section deals with facilities for storing equipment. One of the appealing characteristics of this booklet is that it describes in broad terms the general requirements for good results — and the best methods of obtaining them — but does not go into burdensome detail.

The final section describes the steps required to achieve the goals previously outlined, focusing the attention of all planners on the activities for which provision should be made, and getting all to support the program. Teachers, particularly, should be consulted. A final paragraph invites comments from readers who need more information or have additional ideas to share with others. A bibliography cites 26 articles and books on subjects relating to this problem.

In view of the large number of schools now being planned or remodeled, and in view of the demonstrated need for a better understanding of the requirements for audio-visual aids, this booklet should be given immediate, wide circulation among those who plan classrooms.—*D. F. Lyman*, Development Dept., Camera Works, Eastman Kodak Co., Rochester 4, N.Y.

Proceedings of the London Conference on Optical Instruments 1950

(Held at Imperial College, London, July 1950.) Published (1952) by John Wiley & Sons, 440 Fourth Ave., New York 16. i-xv + 256 pp. + 8 pp. index. 100 illus. 5 × 8 in. Price $7.00.

Kingslake reviews recent developments in photographic lenses under high index glasses, double-, triple- and four-element systems, high aperture, Petzval types, wide angle, telephoto, afocal, zoom, catadioptric system, increased depth of field, aspheric surfaces, mechanical improvements and other materials. Over 170 patents, not counting duplicates in other countries, have issued on photographic lenses since 1940. H. H. Hopkins discusses the zoom lenses as symmetrical systems of variable power. Improvements possible in high aperture lenses having spherical fields (curved film) are discussed by Warmisham. The remaining five-sixths of the report covers reflecting microscopes, gratings and their instruments, phase microscopes, spectrophotometers, reflecting telescopes, miscellaneous (velocity of light and measurement of distance; photometry of optical instruments), and new optical materials. This is a good summary of the status in 1950 and gives a fairly complete coverage in a small space. The references provided will meet the immediate need for more detail in each field. Progress has come mainly from the newer glasses of high index and lower dispersions allowing the designer to use simpler constructions, although a few items reveal progress from human ingenuity.—*O. W. Richards*, American Optical Company, Stamford, Conn.

Technical Optics (Vol. II)

By L. C. Martin. Published (1950) by Pitman, 2 W. 45 St., New York 19. 327 pp. + 12 pp. appendix + 4 pp. index. Approx. 260 illus. 5½ × 8½ in. Price $7.50.

Like most books on technical optics this volume follows the regular pattern, having one chapter on single lenses and magnifiers followed by a chapter each for telescopes, magnifiers, photographic lenses, and the testing of optical instruments. In each chapter the historical development is followed by some of the technical questions encountered in the design of optical instruments.

Related topics are the subject of chapters on binocular vision and binocular instruments, photometry (where projection systems and projectors are briefly described),

and aspheric surfaces. In the latter chapter, Schmidt systems and other recent high-speed aspheric systems which are of interest to the projection of television images are discussed. In four appendixes, symbols, defraction gratings, chromatic abberation of thin lenses, and data on seven photographic lenses are given.

The publisher states, "the book is of the greatest value to scientific instrument makers, ophthalmic opticians, spectacle makers, and students." The technical descriptions and derivations do not make this book easy to read for the casual reader but rather a book for the student and scientific user of optical instruments. Even though it can serve as a useful reference or study book of technical optics it cannot be classified as a treatise on the subject. A great majority of the references are to British works and authors, and little mention is made of work done in other countries.

Engineers and physicists dealing with the design of optical instruments will find this book a valuable addition to their library. Other American readers who want an insight into this branch will, no doubt, prefer *Fundamentals of Optical Engineering* by D. H. Jacobs, or *The Principles of Optics* by A. C. Hardy and F. H. Perrin.—*Dr. John L. Maulthesch*, Vice-President, Kollmorgen Optical Corp., 347 King St., Northampton, Mass.

Focal Cinebooks

A special series of inexpensive, popular monographs on motion picture subjects, consisting of the following:

How to Script, by Oswell Blakeston, 1st ed., 1949
How to Film, by G. Wain, 3d ed., 1952
How to Direct, by Tony Rose, 1st ed., 1949
How to Edit, by H. Baddeley, 1st ed., 1951
How to Act, by Tony Rose and Martin Benson, 1st ed., 1951
How to Process, by Leslie J. Wheeler, 1st ed., 1950
How to Title, by L. F. Minter, 1st ed., 1949
How to Project, by Norman Jenkins, 2d ed., 1951
How to Cartoon, by John Halas and Bob Privett, 1st ed., 1951
How to Use 9.5mm, by D. M. Neale, 1st ed., 1951

Published by Focal Press Ltd., 31 Fitzroy Sq., London, W. 1, England. Paper bound. Price 7s. 6d.

This series of popular monographs is, in a sense, the motion picture counterpart to Focal Press' famous series of basic booklets in still photography. However, for the "still" series the titles were characterized by the two-word prefix "All About" instead of "How to," as in the present series. The general level of the motion picture booklets is considerably more advanced than that established for the still booklets; nevertheless, by no stretch of the imagination can the motion picture booklets be recommended to the specialist, except possibly to the extent that a specialist in one field might find the booklets on subjects outside his respective field worth reading. For example, a director or film editor could derive some insight into the complexities of processing by a reading of *How to Process*. But he would gain a false impression of modern motion picture laboratory practice if he went no further, for the booklet treats the subject entirely from a standpoint of home processing on old-fashioned drums.

The booklets generally are well written and thoroughly illustrated. They are obviously directed to the serious amateur who wants to improve his film results and dabble in home laboratory procedures.—*Lloyd E. Varden*, Pavelle Color, Inc., 533 W. 57 St., New York 19, N.Y.

SMPTE Officers and Committees: The roster of Society Officers and the Committee Chairmen and Members were published in the April *Journal*.

Positions Wanted

Production, TV or Motion Picture: NYU BA in motion picture and TV production; participated in productions as director and unit mgr; experience as motion picture sensitometrist; at present motion picture negative assembler and cutter; worked swing shift while attending college; licensed 35mm projectionist; single, 29, veteran, resume on request; go anywhere. Harold Bernard, 560 Eastern Pkwy, Brooklyn 25, N.Y.

TV Producer-Director: Now Chief of Production in Army's first mobile TV system; military experience in writing-directing high-speed, low-cost instructional productions; formerly TV producer-director, KRON-TV San Francisco, five shows weekly; will be separated from service Nov. 1952; desire connection in educational TV, preferably employing kinescope techniques; married; prefer West Coast, but willing to travel; résumé, script samples, pictures of work — on request; 1st Lt. Robert Lownsbery, SigC Mbl TV Sys, c/o Sig Photo Center, 35-11 35th Ave., Long Island City 1, N.Y.

Journals Available and Wanted

Available

Upon a reasonable offer to Alfred S. Norbury, 3526 Harrison St., Kansas City 3, Mo.:

Vol. 44 (Jan.-June 1945)
Vol. 45 (July-Dec. 1945)
Vol. 47 (July-Dec. 1946)
Vol. 48 (Jan.-June 1947)
Vol. 49 (July-Dec. 1947)
Vol. 50 (Jan.-June 1948)
Vol. 51 (July-Dec. 1948)
Vol. 52 (Jan.-June 1949)
Vol. 56 (Jan.-June 1951)
Vol. 57 (July-Dec. 1951)

A set of Journals from January 1945 through 1951 at $15.00 plus packing and carrying costs from Richard W. Maedler, 32–52 — 46 St., Long Island City 3, N.Y.

Complete set, in excellent condition, from January 1930 to date, plus one issue of September 1928 from Don Canady, 5125 Myerdale Drive, R.R. 15, Cincinnati, 36, Ohio.

5 years (1947–51) in perfect condition plus the indexes for 1936–45 and 1946–50 and including the 1949 High-Speed Photography, upon any reasonable offer to Vic Gretzinger, 3547 Suter St., Oakland 19, Calif.

Transactions Nos. 11, 14, 20, 21, 23, 25, 27, 28 and 38; and 22 years of the *Journal* (1930–1951) except for Jan., Feb., Mar. and Apr. of 1934, Jan. and Apr. of 1948, and Feb. 1950; also these extra single copies — Nov. 1930; Jan., Feb., July and Nov. 1931; June 1932; Mar. and Apr. 1933; Dec. 1934; Jan. and May 1935; Oct. 1938; July and Dec. 1940; Oct. 1948 and Jan. 1950, upon any reasonable offer made to Paul J. Larsen, Assistant to the President, Borg-Warner Corp., 310 So. Michigan Ave., Chicago 4, Ill.

Wanted

Transactions 1, 6 and 7. Contact Mrs. Dorothy Gelatt, Henry M. Lester, 101 Park Ave., New York 17, N.Y.

High-Speed Photography, Volume 1, reprint or original Journal, March 1949, Part II, by John H. Waddell, Wollensak Optical Co., 850 Hudson Ave., Rochester 21, N.Y.

New Members

The following members have been added to the Society's rolls since those last published. The designations of grades are the same as those used in the 1952 MEMBERSHIP DIRECTORY.

Honorary (H) Fellow (F) Active (M) Associate (A) Student (S)

Barker, Lovell H., Film Processing Laboratory Owner. **Mail:** 9208 Memorial, Detroit 28, Mich. (M)

Bernstein, Paul, TV Studio Technician and Engineer, WOI-TV, Iowa State College, Ames, Iowa. (A)

Blanchard, Vernon W., Chemist, E. I. Du Pont de Nemours & Co., Photo Products Dept. **Mail:** 42 South Drive, Lawrence Brook Manor, Rt. 9, New Brunswick, N.J. (A)

Bostwick, James W., Manager, Motion Pictures & Slide Films, General Motors Photographic, General Motors Corp., B-120 GM Bldg., Detroit 2, Mich. (M)

Brasier, C. S., Scientific Photographer, Ministry of Supply, British Government. **Mail:** 4 Romney Rd., Southcourt, Aylesbury, Bucks, England. (A)

Carter, Bryan, Chief Electrician, Universal Pictures Co., Universal City, Calif. (M)

Chessman, Walter E., Jr., Mechanical Engineer, Alexander Film Co. **Mail:** 1516 Vista Pl., Colorado Springs, Col. (A)

Coan, Edward M., Television Engineer, Allen B. DuMont Laboratories, Inc. **Mail:** 37 Overlook Rd., Cedar Grove, N.J. (M)

Cook, George R., Treasurer, Radio Station WLS. **Mail:** 1419 Lathrop Ave., River Forest, Ill. (M)

Cotcher, Alfred L., Electronic Scientist, National Bureau of Standards. **Mail:** 3410 Highview Ct., Wheaton, Md. (A)

Dobbs, Frank S., Manufacturer, Cine Products Supply Corp., Ashland, N.J. (M)

Drucker, Donald, Motion Picture Film Editor, Charles R. Sene. **Mail:** 6804 — 18 Ave., Brooklyn, N.Y. (A)

Faithorn, Nathaniel R., Television Engineer, The Associated Broadcasters, Inc. **Mail:** 430 Myra Way, San Francisco 16, Calif. (A)

Filmer, Philip, General Manager, General Motors Photographic, General Motors Corp., 407 General Motors Research Bldg., Detroit, Mich. (M)

Green, Phil C., Television Engineer, WSM Television. **Mail:** 4112 Rockdale Ave., Nashville, Tenn. (A)

Hewins, Leonard J., Manager, Mole-Richardson (Spain). **Mail:** Garcia Morato 121, Madrid, Spain. (M)

Huffman, Robert L., Mechanical Engineer, Automatic Electric Co. **Mail:** 1033 W. Van Buren St., Chicago 7, Ill. (A)

Karo, James, Photographic Supervisor, Sandia Corp. **Mail:** 1123 Silver Ave., S.W., Albuquerque, N.M. (A)

Keller, John S., Supervisor, Field Optical Installations, Sandia Corp. **Mail:** San Felipe Lodge, Apt. 201, Salton Sea Base, Westmorland, Calif. (M)

Koch, William A., Chemist, Eastman Kodak Co., 342 Madison Ave., New York 17, N.Y. (M)

Lenz, Irvin W., High-Speed Motion Picture Camera Technician, Sandia Corp., Field Test Dept., Sandia Base, Albuquerque, N.M. (A)

Macauley, Alan C., 16mm Production and Distribution, World Films. **Mail:** Box 72, Sierra Madre, Calif. (A)

Marcus, Paul, Chief Engineer, Partner, Bell Recording Co., 112 W. 89 St., New York 24, N.Y. (A)

Matt, Richard J., Producer, Box 581, Fond du Lac, Wis. (M)

McNaughten, Neal, Director of Engineering, National Association of Radio and Television Broadcasters, 1771 "N" St., N.W., Washington 6, D.C. (M)

Moore, Charles S., Supervisor of Sound Engineers, Radio Corporation of America. **Mail:** 6703 Starling Cir., Dallas, Tex. (A)

Pendreigh, Harold A., Projectionist, J. Kelly and R. Pannett. **Mail:** 88 George St., Rockhampton, Queensland, Australia. (A)

Peterson, Harry, Cinematographer, Atlas Film Corp. **Mail:** 411 Marion St., N., Oak Park, Ill. (M)

Rafalon, Jules, Mechanical Engineer, Assistant Chief, Pathe Laboratories, Inc., 105 E. 106 St., New York 29, N. Y. (M)

Read, Edmond C., Jr., Kinescope Recording Engineer, National Broadcasting Co. **Mail:** 4038 Michael Ave., Venice, Calif. (M)

Reiter, Samuel S., New York University. **Mail:** 1937 E. 37 St., Brooklyn 34, N.Y. (S)

Richardson, Robert W., Motion Picture Writer, Photographer and Producer, Barber-Greene Co., 400 Highland Ave., Aurora, Ill. (M)

Rowe, Thomas L., Chief Engineer, Radio Station WLS. **Mail:** 2324 W. Lunt, Chicago 45, Ill. (M)

Ruberg, Elden E., Sound Technician, Radio Corporation of America. **Mail:** 1039 Hartzell St., Pacific Palisades, Los Angeles, Calif. (A)

Strauch, Frederic P., Jr., Sales Engineer, Bell & Howell Co. **Mail:** 1122 Dartmouth, Wilmette, Ill. (A)

Wilner, John, Director of Engineering, Hearst Corp., 2610 N. Charles St., Baltimore 18, Md. (A)

Wilson, Ralph J., Supervisor, Photo Section, Sandia Corp. **Mail:** 295 C St., Brawley, Calif. **(A)**

Winkler, Edward A., Chemical Engineer, Eastman Kodak Co., 342 Madison Ave., New York 17, N.Y. **(M)**

Wolf, George E., Assistant Production Manager, Murphy-Lillis Productions, Inc. **Mail:** 3 Glenwood St., Little Neck, L.I., N.Y. **(A)**

Wood, Donald M., In Charge of Research Photography, Bendix Aviation Corp. **Mail:** 10410 E. Jefferson, Detroit 14, Mich. **(A)**

Zaccardi, Sgt. Carmie M., Motion Picture Photographer, U.S. Air Force, Box 494, Hq. AFFTC, Edwards Air Force Base, Edwards, Calif. **(A)**

Zost, Elmer G., Chemist, Alexander Film Co., Alexander Film Bldg., Colorado Springs, Col. **(A)**

CHANGES IN GRADE

Drew, R. O., **(A)** to **(M)**
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Paramasivaiah, P., **(S)** to **(A)**

Current Literature

The Editors present for convenient reference a list of articles dealing with subjects cognate to motion picture engineering published in a number of selected journals. Photostatic or microfilm copies of articles in magazines that are available may be obtained from The Library of Congress, Washington, D.C., or from the New York Public Library, New York, N.Y., at prevailing rates.

American Cinematographer
vol. 33, June 1952

Economy Set Lighting With Cone Lights (p. 248)

Camera Heater for Cold-weather Filming (p. 250) *R. Lawton*

vol. 33, July 1952

Stereo Movies Without Spectacles (p. 295) *A. D. Roe*

Filters in Cinematography (p. 296) *J. Forbes*

Electronic-Photo Recording—New TV Filming Method (p. 298) *C. L. Anderson*

Bild und Ton
vol. 5, May 1952

Die transportable Riffelwand (p. 150) *G. Hoffmann*

Warum zerspringen Stufenlinsen? (p. 136) *H. Jentzsch*

Mikrofotografie im Dienste der Kreislaufforschung (p. 139) *G. Vogel*

British Kinematography
vol. 20, May 1952

Problems of Storing Film for Archive Purposes (p. 150) *H. G. Brown*

Electronic Engineering
vol. 24, July 1952

Some Convertor Tubes and Their Applications (p. 302) *J. A. Jenkins and R. A. Chippendale*

A Method of Measuring Television Picture Detail (p. 308) *G. G. Gouriet*

Electronics
vol. 25, June 1952

Pack-Carried Television Station (p. 98) *L. E. Flory, W. S. Pike, J. E. Dilley and J. M. Morgan*

Self-Focusing Picture Tube (p. 107) *A. Y. Bentley, K. A. Hoagland and H. W. Grossbohlin*

Kino-Technik
no. 5, May 1952

Deutsche Ausfuhr von Kino-Film rollt langsam an (p. 101)

Geiselgasteig ist für den Farbfilm gerüstet (p. 102)

Das Bild der deutschen Filmwirtschaft—gestern und heute (p. 105) *A. N. Narath*

Welche Anforderungen stellt das Fernsehen an den Rohfilm? (p. 114)

Störungen bei der Vorführung von Farbfilmen (p. 117) *K. Braune and H. Tümmel*

no. 6, June 1952

Welche Anforderungen stellt das Fernsehen an den Rohfilm? (p. 149)

Störungen bei der Vorführung von Farbfilmen (p. 151) *K. Braune and H. Tümme*

Radio & Television News
vol. 47, June 1952
(Radio-Electronic Engineering Section)

What's Ahead for Small-Town Television? (p. 31) *N. Sklarewitz*

Radio & Television News
vol. 48, July 1952

Improved Intercarrier Sound System (p. 36) *W. H. Buchsbaum*

Unique Magnetic-Tape Applications (p. 38) *L. A. Wortman*

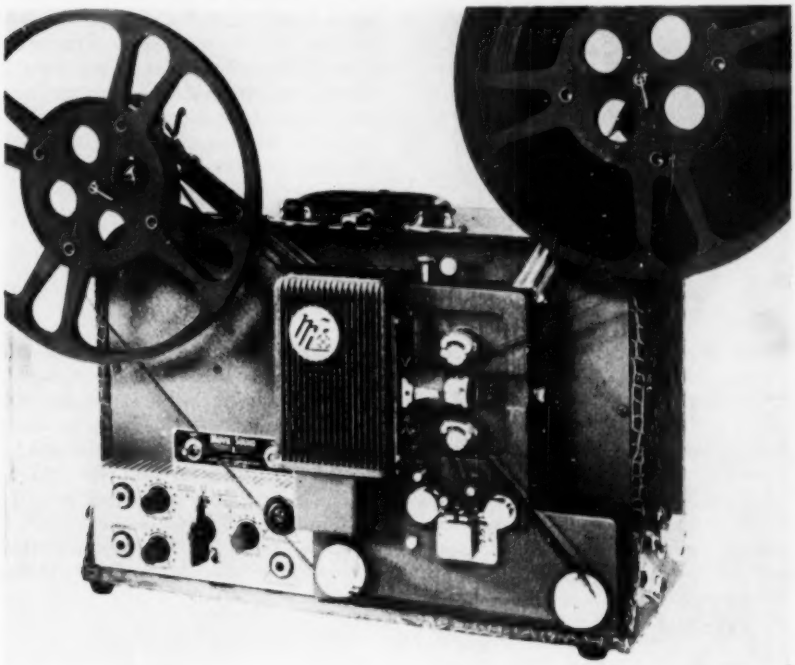
Pulses in Sound Reproduction (p. 59) *G. Southworth*

Tele-Tech
vol. 11, Aug. 1952

Eidophor Projector for Theatre TV (p. 112)

New Products

Further information about these items can be obtained direct from the addresses given. As in the case of technical papers, the Society is not responsible for manufacturers' statements, and publication of these items does not constitute endorsement of the products.



Movie Sound 8 is the first commercially available equipment for recording and reproducing magnetic sound on 8mm film. The equipment comes in a single case, including a built-in 6-in. speaker and a microphone, and is marketed at $398.50 by Movie Mite Corp., 1105 Truman Rd., Kansas City 6, Mo. Magnetic striping of 8mm film is now available at 3½¢ a foot from Reeves Soundcraft Corp., 10 E. 52 St., New York 22, N.Y.

Movie Mite Corp. felt that an entirely new projector should be designed to get sound successfully on 8mm, chiefly to overcome wow and flutter problems and to provide 24 frame/sec sound speed and also the old, silent speed. To avoid sprocket hole modulation, a system called the Roto-Magnetic Stabilizer was developed to allow scanning the film in a flat plane. The use of a slightly tapered sound drum provides a substantial amount of the edge guiding needed. There are only two sprockets. They are driven by a worm gear connected by a rubber belt to the motor.

The standard projector has two input positions — for the record player and for the microphone. A small mixer is available for the operator who wishes to record from two records and a microphone. It is not necessary to use special film stock. Old 8mm films as well as new can be given the 25-mil magnetic stripe which is placed outside the perforations.

New electronic humidity controls are described in Bulletin F-5173 recently issued by Barber-Colman Co., Rockford, Ill. It is called two-position and proportioning for process or comfort control. It is a plug-in element designed for wide range with simple adjustments. In spaces supplied by a central fan, the sensing element is mounted either in the duct or the conditioned space, remote from the amplifier and adjustments. For controlling humidity in spaces not completely air conditioned, the control is available with the operating adjustment mechanism mounted in a cabinet.

Nema Movie Guide — 1952 is a compilation of complete data on "16mm Electrical Films." The Guide covers 409 films giving running time, color, sales or rental prices, release dates when ascertainable, sources (producer or chief distributor, with other possibilities covered in an extensive index of producers and distributors), and grading of films when that was obtainable, with keys for: guide or manual; primary; elementary; junior high school; senior high school; college; trade school and trade; and adult education. A 6-page "Classification by Subjects" makes this Guide very useful. It should be noted that there is only one film distributed by NEMA — *Installing Armored Cable.* All the other 408 films must be ordered from the sources listed. The Nema Movie Guide is available from the National Electrical Manufacturers Association, 155 E. 44 St., New York 17, N.Y.

Meetings

72d Semiannual Convention of the SMPTE, Oct. 6-10, Hotel Statler, Washington, D. C.

Other Societies

National Electronics Conference, Annual Meeting, Sept. 29–Oct. 1, Sherman Hotel, Chicago, Ill.

Optical Society of America, Oct. 9–11, Hotel Statler, Boston, Mass.

American Institute of Electrical Engineers, Fall General Meeting, Oct. 13–17, New Orleans, La.

American Physical Society, Oct. 17–18, Cornell University, Ithaca, New York

Acoustical Society of America, Nov. 13–15, Balboa Park, San Diego, Calif.

American Standards Association, Annual Meeting, Nov. 19, Waldorf-Astoria, New York

American Physical Society, Nov. 28–29, Washington University, St. Louis, Mo.

American Institute of Chemical Engineers, Annual Meeting, Dec. 7–10, Cleveland, Ohio

Institute of Radio Engineers Conference and Electronics Show, 5th Annual Southwestern Conference and Show, Feb. 5–7, San Antonio, Texas

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